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FILE: RESULTS OF AN INVESTIGATION OF HYPERSONIC VISCOUS

EFFECTS ON AN 0.01 SCALE SPACE SHUTTLE ORBITER 51-O

AEDC-VKF HYPERVELOCITY WIND TUNNEL (0A81)

NUMBER: DR-2152 DATE: October, 1974 BRANCH: Flight

The attached Revision A of DMS-DR-2152 completely replaced the original report dated October, 1974.

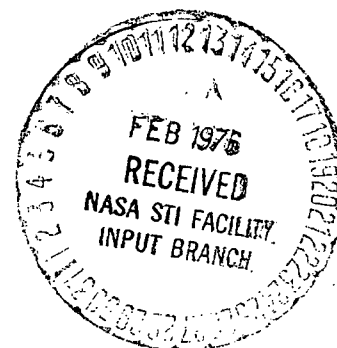
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SPACE SHUTTLE

AEROTHERMODYNAMIC DATA REPORT

JOHNSON SPACE CENTER

HOUSTON, TEXAS



DATA MANAGEMENT services

SPACE DIVISION



CHRYSLER
CORPORATION

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THE FOLLOWING CHANGES APPLY TO PUBLICATION: DMS-DR-2152

TITLE: RESULTS OF AN INVESTIGATION OF HYPERSONIC VISCOUS INTERACTION
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AEDC-VKF HYPERVELOCITY WIND TUNNEL (0A81)

NUMBER: DR-2152 DATE: October, 1974 BRANCH: Flight Technology

The attached Revision A of DMS-DR-2152 completely replaces DMS-DR-2152 dated October, 1974.

This revision is published to:

- 1) incorporate the updated data released in May 1975 for Mach 16, $Re/ft. 0.5 \times 10^6$.
- 2) correct the improper XCP/L values in the old report
- 3) add \bar{V}_∞ values to the data array
- 4) add contamination factor (F) to Mach 20 data
- 5) add data plots

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PAGE 1 OF 1

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CORPORATION

December, 1975

REVISION A
DMS-DR-2152
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RESULTS OF AN INVESTIGATION OF HYPERSONIC
VISCOUS INTERACTION EFFECTS ON AN 0.01
SCALE SPACE SHUTTLE ORBITER 51-O MODEL IN
THE AEDC-VKF HYPERVELOCITY WIND TUNNEL
(OA81)

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by

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Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number: AEDC F VA489
NASA Series Number: OA81
Model Number: 51-0
Test Dates: 26 November through 27 December 1973
Occupancy Hours: 90

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Chrysler Corporation Space Division assumes no responsibility for the data presented other than display characteristics.

RESULTS OF AN INVESTIGATION OF HYPERSONIC
VISCOUS INTERACTION EFFECTS ON AN 0.01
SCALE SPACE SHUTTLE ORBITER 51-0 MODEL IN
THE AEDC-VKF HYPERVELOCITY WIND TUNNEL

(0A81)

By

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ABSTRACT

The major hypersonic aerodynamic results obtained experimentally from the 0.010-scale (51-0) 140A/B Orbiter vehicle are presented herein. The results were obtained from the AEDC-VKF Hypervelocity Wind Tunnel F under test 0A81.

The test was conducted over an angle-of-attack range from 20 to 35 degrees for nominal Mach numbers of 16 and 20. The Mach 16 data were obtained at Reynolds numbers, based on model length, of nominally 0.54×10^6 and 1.18×10^6 . The Mach number 20 data were obtained at nominal Reynolds numbers of 0.08×10^6 and 0.27×10^6 . Various elevon deflections ($\delta_e = -40$ degrees, 0 degrees, +15 degrees) and body flap deflections ($\delta_{BF} = -11.7$ degrees, 0 degrees, +16.3 degrees) were tested for determination of control effectiveness. The test objectives were as follows:

- 1) Verify December 1973 Aerodynamic Design Data Book estimates for $M_\infty > 10$.
- 2) Determine configuration forward and aft trim boundaries and control characteristics.
- 3) Determine high Mach number - low Reynolds number effects.
- 4) Determine if positive control surface flow separation is present and magnitude of separation effects.

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TABLE OF CONTENTS

	Page
ABSTRACT	iii
INDEX OF FIGURES	2
NOMENCLATURE	3
REMARKS	9
CONFIGURATIONS INVESTIGATED	11
INSTRUMENTATION	12
TEST FACILITY DESCRIPTION	14
DATA REDUCTION	15
REFERENCES	18
TABLES	
I. TEST CONDITIONS	19
II. DATASET/RUN NUMBER COLLATION SUMMARY	20
III. MODEL DIMENSIONAL DATA	21
MODEL FIGURES	30
APPENDIX	
TABULATED SOURCE DATA	89

INDEX OF FIGURES

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1.	Axis systems.	30
2.	Model sketch.	31
3.	Model photograph.	32
4.	AEDC contamination correction factor.	33
5.	Hypersonic characteristics of space shuttle orbiter 140 A/B.	34

NOMENCLATURE
General

<u>SYMBOL</u>	<u>PLOT SYMBOL</u>	<u>DEFINITION</u>
a		speed of sound; m/sec, ft/sec
C_p	CP	pressure coefficient; $(p_1 - p_\infty)/q$
M	MACH	Mach number; V/a
p		pressure; N/m^2 , psf
q	Q(NSM) Q(PSF)	dynamic pressure; $1/2\rho V^2$, N/m^2 , psf
RN/L	RN/L	unit Reynolds number; per m, per ft
V		velocity; m/sec, ft/sec
α	ALPHA	angle of attack, degrees
β	BETA	angle of sideslip, degrees
ψ	PSI	angle of yaw, degrees
ϕ	PHI	angle of roll, degrees
ρ		mass density; kg/m^3 , slugs/ft ³

Reference & C.G. Definitions

A_b		base area; m^2 , ft^2
b	BREF	wing span or reference span; m, ft
c.g.		center of gravity
$\frac{l_{REF}}{c}$	LREF	reference length or wing mean aerodynamic chord; m, ft
S	SREF	wing area or reference area; m^2 , ft^2
	MRP	moment reference point
	XMRP	moment reference point on X axis
	YMRP	moment reference point on Y axis
	ZMRP	moment reference point on Z axis

SUBSCRIPTS

b	base
l	local
s	static conditions
t	total conditions
∞	free stream

NOMENCLATURE (Continued)

Body-Axis System

<u>SYMBOL</u>	<u>PLOT SYMBOL</u>	<u>DEFINITION</u>
C_N	CN	normal-force coefficient; $\frac{\text{normal force}}{qS}$
C_A	CA	axial-force coefficient; $\frac{\text{axial force}}{qS}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_{A_b}	CAB	base-force coefficient; $\frac{\text{base force}}{qS}$ $-A_b(P_b - P_\infty)/qS$
C_{A_f}	CAF	forebody axial force coefficient, $C_A - C_{A_b}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS l_{REF}}$
C_n	CYN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qS b}$
C_l	CBL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qS b}$

Stability-Axis System

C_L	CL	lift coefficient; $\frac{\text{lift}}{qS}$
C_D	CD	drag coefficient; $\frac{\text{drag}}{qS}$
C_{D_b}	CDB	base-drag coefficient; $\frac{\text{base drag}}{qS}$
C_{D_f}	CDF	forebody drag coefficient; $C_D - C_{D_b}$
C_Y	CY	side-force coefficient; $\frac{\text{side force}}{qS}$
C_m	CLM	pitching-moment coefficient; $\frac{\text{pitching moment}}{qS l_{REF}}$
C_n	CLN	yawing-moment coefficient; $\frac{\text{yawing moment}}{qS b}$
C_l	CSL	rolling-moment coefficient; $\frac{\text{rolling moment}}{qS b}$
L/D	L/D	lift-to-drag ratio; C_L/C_D
L/D_f	L/DF	lift to forebody drag ratio; C_L/C_{D_f}

NOMENCLATURE - Continued
Additions to Standard List

<u>Symbol</u>	<u>Plot Symbol</u>	<u>Definition</u>
C_{AE}	CAE	estimated axial-force coefficient, $(C_{Af_E} + C_{Ab})$ M = 20 data only
C_{Af_E}	CAFE	estimated forebody axial-force coefficient (see reference 1); M = 20 data only, see page 16
C_{Af}	CAF	forebody axial-force coefficient, $(C_A - C_{Ab})$ or $(C_{Ap} + C_{Av})$
C_{AM}	CAM	experimental axial-force coefficient, Mach = 20 data only; includes viscous force produced by tunnel flow contamination (see reference 1) and base pressure drag
C_{Af_M}	CAFM	experimental forebody axial-force coefficient, $(C_{AM} - C_{Ab})$; M = 20 data only
C_{Av}		viscous axial-force coefficient
C_{Ap}		pressure axial-force coefficient
C_{PB}	CPB	base pressure coefficient, $(P_B - P_\infty)/q_\infty$
C_∞		Chapman-Rubesin viscosity coefficient, $(\mu_w/\mu_\infty)(T_\infty/T_w)$
C_∞^1		factor of proportionality as defined in Data Reduction section
F	C-FCTR	AEDC contamination correction factor, $(C_{Af_M}/C_{Af_E}) - 1$; see reference 5; M = 20 data only
F_{AC}		axial force resulting from flow contamination, $F_{AC} = F_{Af_M} - F_{Af_E}$
F_{Af}		forebody axial force corrected for tunnel flow contamination (M _∞ = 20 only)
C_{NM}		measured normal force coefficient

NOMENCLATURE (Continued)

<u>Symbol</u>	<u>Plot Symbol</u>	<u>Definition</u>
F_{AM}		measured total axial force, lb
F_{AfM}		measured forebody axial force, lb
F_N		normal force, lb
F_{NA}		normal force at aft normal-force gage location, lb
F_{NF}		normal force at forward normal-force gage location, lb
h		enthalpy
l_B	L	reference body length, 12.903 in.
M_∞	$MACH$	Mach number
MRP	MRP	moment reference point
M_y		pitching moment in the body axis system, in-lb $M_y = [\text{moment arm}_1 \text{ (in.)} \times F_{NF}] - [\text{moment arm}_2 \text{ (in.)} \times F_{NA}]$ + 0.25 in. (F_{AM} or F_{Af}), in-lb
P_∞	P	free-stream static pressure, psia
P_O	PO	reservoir pressure, psi
P'_O	POP	total pressure behind normal shock in test section, psia
Pr		Prandtl number, 0.71
P_B		model base pressure, psia
\dot{q}_O	QO	stagnation heat-transfer rate on 1.0-in.-diam probe, Btu/ft ² -sec
$\dot{q}(I)$		stagnation heat-transfer rate inferred from shoulder heat gages of 1.0-in.-diam hemisphere-cylinder, Btu/ft ² -sec

NOMENCLATURE (Continued)

<u>Symbol</u>	<u>Plot Symbol</u>	<u>Definition</u>
$Re_{\infty L}$	RE-L	Reynolds number based on free-stream conditions and model length
S_{wet}		wetted area of model lower surface, in ²
St_{∞}		Stanton number, $\dot{q}_w / \rho_{\infty} U_{\infty} (h_0 - h_w)$
$St_{\infty \text{ avg}}$		average Stanton number acting on lower model surface
t	TIME	time, milliseconds
T_{∞}	T-INF	Free-stream temperature, °R
T_0	T0	reservoir temperature, °R
T_w		model surface temperature, °R
U_{∞}	U-INF	free-stream velocity, ft/sec
\bar{V}_{∞}	V-INF	hypersonic viscous parameter, $M_{\infty} \sqrt{C_{\infty}} / \sqrt{RE-L}$
\bar{V}_{∞}^i	VLBAR	viscous interaction parameter, $M_{\infty} \sqrt{C_{\infty}^i} / \sqrt{RE-L}$
X_{cp}/L_M		experimental center-of-pressure location, $(XMRP - CLM \times l_{ref}/CN)/L_B$
X_{cp}/L	XCP/L	corrected center-of-pressure location, (see reference 5) $XCP/L = 0.65 - \bar{c}/L_B$ (CLM/CN)
Z		vertical coordinate of model axis system, see Fig. 2
α_S		sector angle of attack, deg
β	BETA	sideslip angle, deg
δ		control surface deflection angle, deg; positive deflections are:
	AILRON	aileron-left trailing edge down
	ELEVTR	elevator-trailing edge down
	BDFLAP	bodyflap-trailing edge down
	SPDBRK	Speedbrake

NOMENCLATURE (Continued)

<u>Symbol</u>	<u>Plot Symbol</u>	<u>Definition</u>
μ_{∞}		free-stream viscosity
μ_w		viscosity at wall temperature
τ		local shear stress, psi
Subscripts		
e_L or e_R		elevon left and right, respectively
BF		bodyflap
M		experimental values
o		stagnation conditions
SB		speedbrake
∞		free-stream conditions

REMARKS

The data resulting from test OA81 contained several anomalies.

1) Tunnel flow was contaminated with fine dust particles produced by vaporization of copper, tungsten, and beryllium during electrical discharge in the tunnel arc chamber. The contamination problem was most severe at Mach 20/Reynolds number 0.27×10^6 and least severe at Mach 20/Reynolds number 0.08×10^6 . These data have been empirically corrected for contamination effects according to the relationship given in Figure 4.

2) Data recorded at different times during a test shot for the same nominal test condition exhibited significant scatter. This is caused primarily by the timewise variation of freestream conditions (inherent in most hotshot facilities).

3) Flow in the tunnel core had a slightly non-uniform pressure profile. Corrections for flow non-uniformities were determined testing the model in an inverted position and applied to the data.

4) The test section flow was divergent (source flow) because the tunnel F nozzle is conical. Effects of source flow were empirically corrected by procedures developed by AEDC.

Data corrections are summarized in the Data Reduction section of this report. A detailed description of these corrections is given in Reference 1. References 3 through 5 provide detailed independent

REMARKS (Concluded)

analyses of these data, explanation of their anomalies, and judiciously plotted results.

CONFIGURATIONS INVESTIGATED

The model (designated no. 51-0) was an 0.010-scale representation of the Space Shuttle 140A/B Orbiter Configuration, fabricated from magnesium (to minimize weight). The model was comprised of the following components:

<u>Symbol</u>	<u>Description</u>
B ₂₆	140A/B fuselage
C ₉	Configuration 3A canopy
E ₂₆	Configuration 4 elevon
F ₇	Configuration 3A bodyflap
M ₇	Configuration 3A OMS pods
N ₂₈	Configuration 3A OMS nozzles
R ₅	Configuration 3A rudder
V ₈	Configuration 3A vertical stabilizer
W ₁₁₆	Configuration 4 wing

Model elevon deflection angles of -40, 0 and 15 degrees were investigated. Bodyflap deflection angles of -11.7, 0, and 16.3 degrees were investigated. Speedbrake deflection angle was 55 degrees. Figure 2 presents a sketch of the model configuration. Table III provides detailed model component dimensional data.

INSTRUMENTATION

Arc chamber pressure, test section pitot pressure, and probe stagnation and cylindrical section heat transfer rates were measured to determine tunnel flow conditions (see reference 1). Pitot pressures were measured with ± 15 psid strain gauge pressure transducers calibrated at the specific pressure level occurring during each test condition. The stagnation heat transfer rates used in determining the tunnel flow conditions were inferred from measurements made on the cylindrical sections of two 1-inch diameter hemisphere-cylinder probes using 10 mil resistance thermometer slug calorimeters. Co-axial thermocouple gauges located at the stagnation points of these same probes were used as flow contamination monitors. The arc chamber reservoir pressure was measured using two strain gauge transducers, each having full-scale calibrated ranges of 5, 10, and 25 thousand psia.

Aerodynamic forces were measured using six-component force balances developed by AEDC VKF for use in hotshot-type tunnels. The balance load cells were instrumented with semiconductor strain gauges, and semiconductor accelerometers provided compensation for model inertia loads that result from vibrations of the model and its support hardware.

Base pressure measurements were made using Invar pressure transducers with a range of 0.001-0.1 psid and were mounted on the sting at the base of the model with the gauge orifice pointing downstream and protruding approximately 1/16-inch beyond the base of the model.

All test data were recorded on a 70-channel digital system capable of

INSTRUMENTATION - Concluded.

scanning all channels in one msec and storing up to 150 scans of data.

Basic data reduction was done off-line with a digital computer.

As a backup to the digital system, as well as to provide a quick-look at data results, output of each data channel was recorded on an oscillograph.

TEST FACILITY DESCRIPTION

The Hypervelocity Wind Tunnel F (reference 1) is an arc-driven wind tunnel of the hotshot type and capable of providing Mach numbers from about 8 to 20 over a Reynolds number per foot range from 0.05×10^6 to 70×10^6 . Test sections of 108-inch diameter ($M_\infty = 14$ to 20) and 54-inch diameter ($M_\infty = 10$ to 17) are available using a four-degree half-angle conical nozzle. The range of Mach numbers at a particular test section in the conical nozzle is obtained by using various throat diameters. The $M_\infty = 8$ contoured nozzle has a 25-inch exit diameter which connects to the 54-inch diameter test section and provides a free-jet exhaust. Nitrogen is the test gas used for aerodynamic studies; air is used for combustion tests. The test gas is confined to either a 1.0-, 2.5-, or a 4.0-cu-ft arc chamber where it is heated and compressed by an electric arc discharge. The increase in pressure results in a diaphragm rupture with the subsequent flow expansion through the nozzle. Test times are typically from 40 to 200 msec. Shadowgraph and Schlieren coverage are available at both test sections.

This test was conducted in the 108-inch diameter test section of the conical nozzle for both the Mach 16 and 20 test conditions. The 2.5-ft³ arc chamber was used and useful test times for Mach 16 and 20 were approximately 40 to 70 msec, respectively. Because of the relatively short test times, the model wall temperature remained essentially invariant from the initial value of approximately 540°R; thus, $T_w/T_o = 0.15$ which approximates the condition of practical interest for reentry vehicles.

DATA REDUCTION

Freestream test conditions were computed using timewise measurements of reservoir pressure, test section pitot pressure, and reference hemisphere cylinder stagnation and shoulder heat transfer rates. Fay and Riddell stagnation point heat transfer theory was used to compute reservoir enthalpy. Quasi-steady isentropic flow equations were used to compute other freestream parameters.

Balance data were reduced to coefficient form in body and stability axes by standard AEDC methods using the following constants:

<u>Description</u>	<u>Value</u>	
	<u>full scale</u>	<u>model scale</u>
reference area, S , ft^2	2690.0	0.2690
reference chord, \bar{c} , in.	474.8	4.748
reference span, b , in.	936.7	9.367
reference body length, ℓ_B , in	1290.3	12.903
moment reference point		
XMRP, in. X_0	1076.7	10.767
YMRP, in. Y_0	0.0	0.0
ZMRP, in. Z_0	375.0	3.75
base area, ft^2	417.4	4.174

Mach 16 data were corrected for source and non-uniform flow as follows:

$$C_N = \text{measured } C_N [1 + \text{source correction} \pm \text{non-uniform correction}]$$

$$= \text{measured } C_N [1 + 0.01 \pm 0.0175]$$

$$X_{cp}/\ell = \text{measured } X_{cp}/\ell + \text{source correction} \pm \text{non-uniform correction}$$

DATA REDUCTION - Continued

$$= \text{measured } X_{cp}/l + 0.002 \pm 0.005$$

$$C_m = \left[\frac{XMRP}{l_B} - X_{cp}/l \right] \frac{C_N l_B}{\bar{c}}$$

Mach 20 data contains an additional correction for contamination, computed as follows:

$$\begin{aligned} \dot{q}_0/\dot{q}(I) &= \text{contamination factor} \\ &= \text{ratio of heat transfer rate measured or facility hemisphere-cylinder probe stagnation point to heat transfer rate inferred by measurements on shoulder of probe.} \end{aligned}$$

so that;

$$C_{A_{fE}} = \frac{C_{A_{fM}}}{1+F}$$

where,

$$C_{A_{fM}} = \text{balance measured forebody axial-force coefficient}$$

$$F = \text{AEDC contamination correction factor}$$

$$= \text{function of } \dot{q}_0/\dot{q}(I) \text{ from figure 4}$$

and;

$$\Delta C_A = C_{A_{fM}} - C_{A_{fE}}$$

$$C_N = \text{measured } C_N [1 + (\text{source correction}) + (\text{non-uniform correction})]$$

$$= \text{measured } C_N [1 + 0.01 \pm 0.03]$$

$$X_{cp}/l = \text{measured } X_{cp}/l + \text{source correction} + \text{non-uniform correction} + \text{contamination correction}$$

$$X_{cp}/l = \text{measured } X_{cp}/l + 0.002 + 0.006 - \frac{\Delta C_A}{C_{NM}} \frac{l_c}{l_B}$$

DATA REDUCTION - Concluded

where

l_c = empirical vertical length from contamination axial force center of pressure to moment reference point

= 1.0 inches model scale

$$C_m = \left[\frac{X_{MRP}}{l_B} - X_{cp}/l \right] C_N \frac{l_B}{\bar{c}}$$

AEDC viscous parameter, which is derived and explained in reference 1, is computed as follows:

$$\bar{V}_\infty = \frac{M_\infty \sqrt{C_\infty}}{\sqrt{Re_{\infty L}}}$$

where

$$C_\infty = \frac{\mu_{wall} T_\infty}{\mu_\infty T_{wall}}$$

The NASA/LaRC viscous interaction parameter is defined as: *

$$\bar{V}'_\infty = \frac{M_\infty \sqrt{C'_\infty}}{\sqrt{Re_{\infty L}}}$$

where

$$C'_\infty = \left[\frac{T'}{T_\infty} \right]^K \left[\frac{T_\infty + 122.1 \times 10^{-(5/T_\infty)}}{T' + 122.1 \times 10^{-(5/T')}} \right]^J$$

with the Monaghan's empirical relationship (reference 6) given by:

$$\frac{T'}{T_\infty} = 0.468 + 0.532 \frac{T_w}{T_\infty} + 0.195 \frac{\gamma-1}{2} M_\infty^2$$

where

T_∞ = Freestream static temperature, degrees Kelvin

T_w = Wall temperature (367°K), degrees Kelvin

T^w = Reference temperature, degrees Kelvin

and

K and J are empirical constants. For air, K = 0.5 and J = 1.0

* Equations below are based on temperature in °K, but tab. data are °R.

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6. Bertram, Mitchel H., "Hypersonic Laminar Viscous Interaction Effects on the Aerodynamics of Two-Dimensional Wedge and Triangular Planform Wings," NASA TN D-3523, August 1966

TABLE I.

[illegible]

*REVISED 4/24/74

TABLE III. - MODEL DIMENSIONAL DATA

MODEL COMPONENT: BODY - B₂₆

GENERAL DESCRIPTION: Configuration 140A/B orbiter fuselage

NOTE: B₂₆ is identical to B₂₄ except underside of fuselage has been
refaired to accept W₁₁₆

MODEL SCALE: 0.010 . MODEL DRAWING: SS-A00147, RELEASE 12

DRAWING NUMBER VL70-000143B, -000200, -000205, -006089, -000145,
VL70-000140A, -000140B

<u>DIMENSION:</u>	<u>FULL SCALE</u>	<u>MODEL SCALE</u>
*Length (OML: Fwd Sta. X _O =235), In.	<u>1293.3</u>	<u>12.933</u>
*Length (IML: Fwd Sta. X _O =238), In.	<u>1290.3</u>	<u>12.903</u>
*Max Width (@ X _O = 1528.3), In.	<u>264.0</u>	<u>2.640</u>
Max Depth (@ X _O = 1464), In.	<u>250.0</u>	<u>2.500</u>
Fineness Ratio	<u> </u>	<u> </u>
Area - Ft ²		
Max Cross-Sectional	<u>340.88</u>	<u>0.0341</u>
Planform	<u> </u>	<u> </u>
Wetted	<u> </u>	<u> </u>
Base	<u> </u>	<u> </u>

TABLE III. - Continued.

*REVISED 4/24/74

MODEL COMPONENT: CANOPY - C₉GENERAL DESCRIPTION: Configuration 3A. Canopy used with fuselage B₂₆.MODEL SCALE: 0.010 . MODEL DRAWING: SS-A00147, RELEASE 12DRAWING NUMBER VL70-000143A

<u>DIMENSION:</u>	<u>FULL SCALE</u>	<u>MODEL SCALE</u>
*Length ($X_0 = 434.643$ to 578)	<u>143.357</u>	<u>1.434</u>
Max Width (@ $X_0 = 513.127$)	<u>152.412</u>	<u>1.524</u>
Max Depth (@ $X_0 = 485.0$)	<u>25.000</u>	<u>0.250</u>
Fineness Ratio	<u> </u>	<u> </u>
Area	<u> </u>	<u> </u>
Max Cross-Sectional	<u> </u>	<u> </u>
Planform	<u> </u>	<u> </u>
Wetted	<u> </u>	<u> </u>
Base	<u> </u>	<u> </u>

TABLE III. - Continued.

*REVISED 4/24/74

MODEL COMPONENT : ELEVON - E26GENERAL DESCRIPTION : Configuration 140A/B Orbiter elevonsData are for one of two sides.MODEL SCALE: 0.010MODEL DRAWING: SS-A00148, RELEASE 6DRAWING NUMBER VL70-000200, -006089, -006092

DIMENSIONS	FULL SCALE	MODEL SCALE
Area - Ft^2	<u>210.00</u>	<u>0.0210</u>
Span (equivalent) In.	<u>349.2</u>	<u>3.492</u>
Inb'd equivalent chord, In.	<u>118.004</u>	<u>1.1180</u>
Outb'd equivalent chord, In.	<u>55.192</u>	<u>0.552</u>
Ratio movable surface chord/ total surface chord	<u> </u>	<u> </u>
At Inb'd equiv. chord	<u>0.2096</u>	<u>0.2096</u>
At Outb'd equiv. chord	<u>0.4004</u>	<u>0.4004</u>
Sweep Back Angles, degrees	<u> </u>	<u> </u>
Leading Edge	<u>0.00</u>	<u>0.00</u>
Trailing Edge	<u>- 10.056</u>	<u>- 10.056</u>
Hingeline	<u>0.00</u>	<u>0.00</u>
(Product of area & \bar{c})	<u> </u>	<u> </u>
* Area Moment (Normal to hinge line), Ft^3	<u>1528.25</u>	<u>0.0015</u>
* Mean Aerodynamic Chord, In.	<u>90.7</u>	<u>0.907</u>

TABLE III. - Continued.

MODEL COMPONENT: BODY FLAP - F₇GENERAL DESCRIPTION: Configuration 140A/B Orbiter body flapMODEL SCALE: 0.010 MODEL DRAWING: SS-A00147, RELEASE 12DRAWING NUMBER VL70-000140A, VL70-000145

<u>DIMENSION:</u>	<u>FULL SCALE</u>	<u>MODEL SCALE</u>
Length ($X_0=1520$ to $X_0=1613$), In.	<u>93.000*</u>	<u>0.930</u>
Max Width , In.	<u>262.00</u>	<u>2.620</u>
Max Depth ($X_0 = 1520$), In.	<u>23.00</u>	<u>0.230</u>
Fineness Ratio	<u></u>	<u></u>
Area - Ft ²	<u></u>	<u></u>
Max Cross-Sectional	<u></u>	<u></u>
Planform	<u>142.6</u>	<u>0.143</u>
Wetted	<u></u>	<u></u>
Base	<u></u>	<u></u>

*Model dim. measured from model sta. 15.20

TABLE III. - Continued.

MODEL COMPONENT : OMS/RCS PODS - M₇

GENERAL DESCRIPTION : Configuration 140A/B Orbiter OMS/RCS pods

MODEL SCALE: 0.010 MODEL DRAWING: SS-A00147, RELEASE 12

DRAWING NUMBER : VL70-000145

DIMENSIONS :	FULL SCALE	MODEL SCALE
Length (OMS Fwd Sta $X_0=1233.0$), In.	<u>327.000</u>	<u>3.270</u>
Max Width (@ $X_0 = 1450.0$), In.	<u>94.50</u>	<u>0.945</u>
Max Depth (@ $X_0 = 1493.0$), In.	<u>109.000</u>	<u>1.090</u>
Fineness Ratio	<u> </u>	<u> </u>
Area	<u> </u>	<u> </u>
Max. Cross-Sectional	<u> </u>	<u> </u>
Planform	<u> </u>	<u> </u>
Wetted	<u> </u>	<u> </u>
Base	<u> </u>	<u> </u>

TABLE III. - Continued.

MODEL COMPONENT: NOZZLES - N₂₈GENERAL DESCRIPTION: Configuration 140A/B Orbiter OMS NozzlesMODEL SCALE: 0.010 MODEL DRAWING: SS-A00106, RELEASE 5 (Contour)DRAWING NUMBER: VL70-000140A (Location)

DIMENSIONS:	<u>FULL SCALE</u>	<u>MODEL SCALE</u>
MACH NO.		
Length - In.		
Gimbal Point to Exit Plane		
Throat to Exit Plane		
Diameter - In.		
Exit		
Throat		
Inlet		
Area - ft ²		
Exit		
Throat		
Gimbal Point (Station) - In.		
Upper Nozzle Left Nozzle, In.		
X	<u>1518.00</u>	<u>15.180</u>
Y	<u>- 88.0</u>	<u>- 0.880</u>
Z	<u>492.00</u>	<u>4.920</u>
Right		
Lower Nozzle		
X	<u>1518.00</u>	<u>15.180</u>
Y	<u>88.0</u>	<u>0.880</u>
Z	<u>492.0</u>	<u>4.920</u>
Null Position - Deg.		
Upper Nozzle Left Nozzle:		
Pitch	<u>15°49'</u>	<u>15°49'</u>
Yaw	<u>12°17'</u>	<u>12°17'</u>
Right		
Lower Nozzle		
Pitch	<u>15°49'</u>	<u>15°49'</u>
Yaw	<u>12°17'</u>	<u>12°17'</u>

TABLE III. - Continued.

*REVISED 4/24/74

MODEL COMPONENT: RUDDER - R₅GENERAL DESCRIPTION: Configuration 140C orbiter rudder (identical to
Configuration 140A/B Rudder).MODEL SCALE: 0.010DRAWING NUMBER: VL70-000146B, VL70-000095

<u>DIMENSIONS:</u>	<u>FULL-SCALE</u>	<u>MODEL SCALE</u>
* Area - Ft ²	<u>100.15</u>	<u>.010</u>
Span (equivalent) , In.	<u>201.0</u>	<u>2.010</u>
Inb'd equivalent chord, In.	<u>91.585</u>	<u>0.916</u>
Outb'd equivalent chord , In.	<u>50.833</u>	<u>0.508</u>
Ratio movable surface chord/ total surface chord		
At Inb'd equiv. chord	<u>0.400</u>	<u>0.400</u>
At Outb'd equiv. chord	<u>0.400</u>	<u>0.400</u>
Sweep Back Angles, degrees		
Leading Edge	<u>34.83</u>	<u>34.83</u>
Trailing Trailing Edge	<u>26.25</u>	<u>26.25</u>
Hingeline (Product of Area & c)	<u>34.83</u>	<u>34.83</u>
* Area Moment (Normal to hinge line), Ft ³	<u>610.92</u>	<u>0.00061</u>
*Mean Aerodynamic Chord, In.	<u>73.2</u>	<u>0.732</u>

TABLE III. - Continued.

*REVISED 6/1/74

MODEL COMPONENT: VERTICAL - V₈GENERAL DESCRIPTION: Configuration 140C orbiter vertical tail (identical to configuration 140A/B vertical tail).MODEL SCALE: 0.010DRAWING NUMBER: VL70-000140C, VL70-000146BDIMENSIONS: FULL SCALE MODEL SCALE

TOTAL DATA

Area (Theo) - Ft ²		
Planform	<u>413.253</u>	<u>.04133</u>
Span (Theo) - In.	<u>315.72</u>	<u>3.157</u>
Aspect Ratio	<u>1.675</u>	<u>1.675</u>
Rate of Taper	<u>0.507</u>	<u>0.507</u>
Taper Ratio	<u>0.404</u>	<u>0.404</u>
Sweep-Back Angles, Degrees.		
Leading Edge	<u>45.000</u>	<u>45.000</u>
Trailing Edge	<u>26.25</u>	<u>26.25</u>
0.25 Element Line	<u>41.13</u>	<u>41.13</u>
Chords:		
Root (Theo) WP	<u>268.50</u>	<u>2.685</u>
Tip (Theo) WP	<u>108.47</u>	<u>1.085</u>
MAC	<u>199.81</u>	<u>1.998</u>
Fus. Sta. of .25 MAC	<u>1463.35</u>	<u>14.634</u>
W.P. of .25 MAC	<u>635.52</u>	<u>6.355</u>
B.L. of .25 MAC	<u>0.00</u>	<u>0.00</u>
Airfoil Section		
Leading Wedge Angle - Deg.	<u>10.00</u>	<u>10.00</u>
Trailing Wedge Angle - Deg.	<u>14.92</u>	<u>14.92</u>
Leading Edge Radius	<u>2.00</u>	<u>0.020</u>
Void Area	<u>13.17</u>	<u>0.0013</u>
Blanketed Area	<u>0.00</u>	<u>0.00</u>

TABLE III. - Concluded.

*REVISED 4/24/74

MODEL COMPONENT: WING-W₁₁₆GENERAL DESCRIPTION: Configuration 4

NOTE: Identical to W₁₁₄ except airfoil thickness. Dihedral angle is along
trailing edge of wing.

TEST NO.DWG. NO. VL70-000140A, -000200DIMENSIONS:FULL-SCALEMODEL SCALETOTAL DATAArea (Theo.) Ft^2

Planform

Span (Theo) In.

Aspect Ratio

Rate of Taper

Taper Ratio

Dihedral Angle, degrees

Incidence Angle, degrees

Aerodynamic Twist, degrees

Sweep Back Angles, degrees

Leading Edge

Trailing Edge

0.25 Element Line

Chords:

Root (Theo) B.P.O.O.

Tip, (Theo) B.P.

MAC

* Fus. Sta. of .25 MAC

* W.P. of .25 MAC

* B.L. of .25 MAC

EXPOSED DATA* Area (Theo) Ft^2

* Span, (Theo) In. BP108

* Aspect Ratio

Taper Ratio

Chords

* Root BP108

* Tip $1.00 \frac{b}{2}$

* MAC

* Fus. Sta. of .25 MAC

* W.P. of .25 MAC

* B.L. of .25 MAC

Airfoil Section (Rockwell Mod NASA)

XXXX-64

Root $\frac{b}{2} =$ Tip $\frac{b}{2} =$

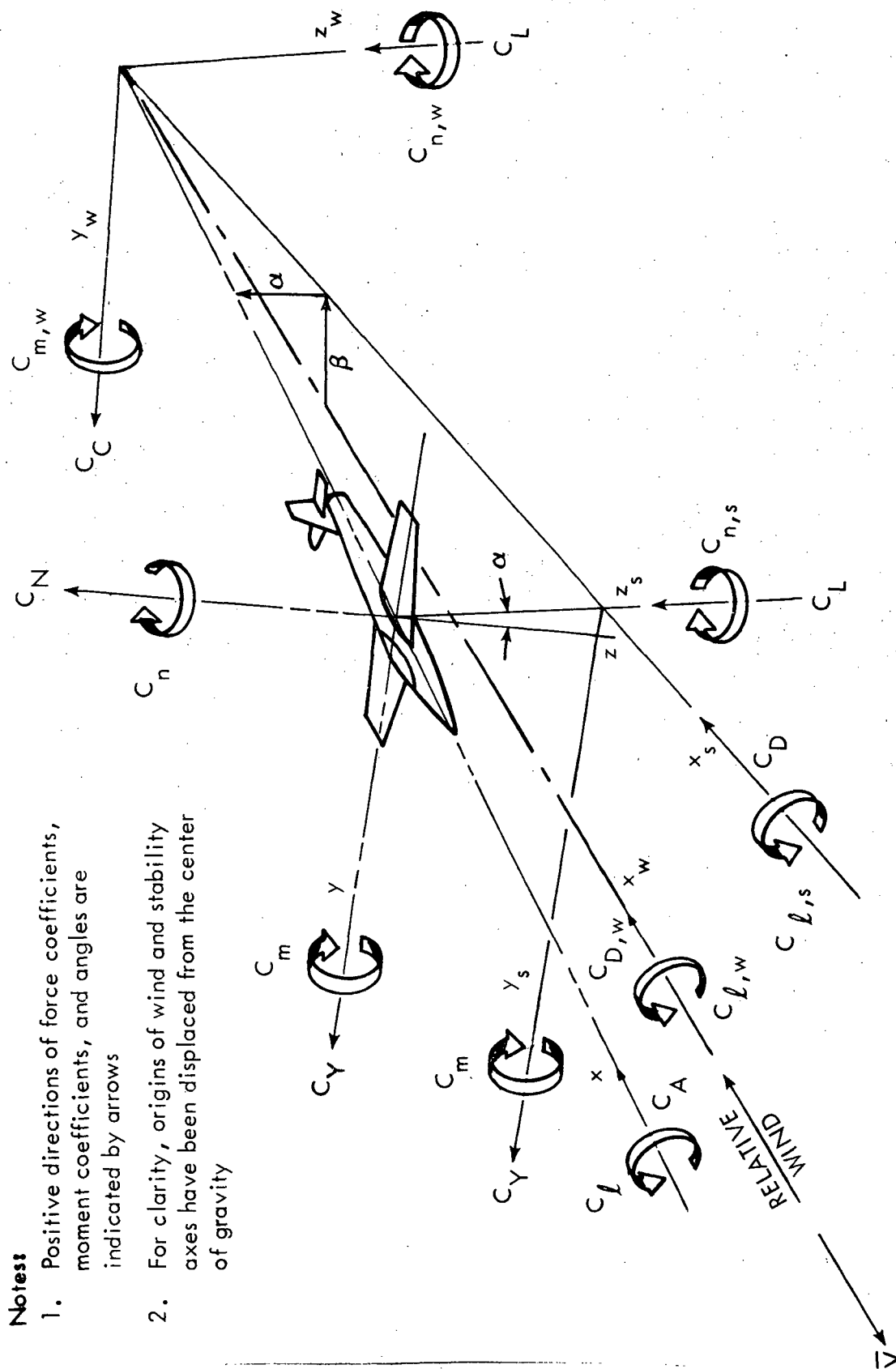
Data for (1) of (2) Sides

Leading Edge Cuff

* Planform Area Ft^2

* Leading Edge Intersects Fus M. L. @ Sta

* Leading Edge Intersects Wing @ Sta



Notes:

1. Positive directions of force coefficients, moment coefficients, and angles are indicated by arrows
2. For clarity, origins of wind and stability axes have been displaced from the center of gravity

Figure 1.- Axis Systems.

REFERENCE	DIMENSIONS
AREA	$S_v = 2690 \text{ FT}^2$
MAC	$C = 474.8 \text{ IN.}$
C.G.	$X_o = 1076.7 \text{ IN.}$
	$Z_o = 375.0 \text{ IN.}$
SPAN	$b_v = 936.68 \text{ IN.}$
LENGTH (IML)	$L_B = 1290.3 \text{ IN.}$
LENGTH (OML)	$L_B = 1293.3 \text{ IN.}$

ALL DIMENSIONS IN
INCHES--FULL SCALE

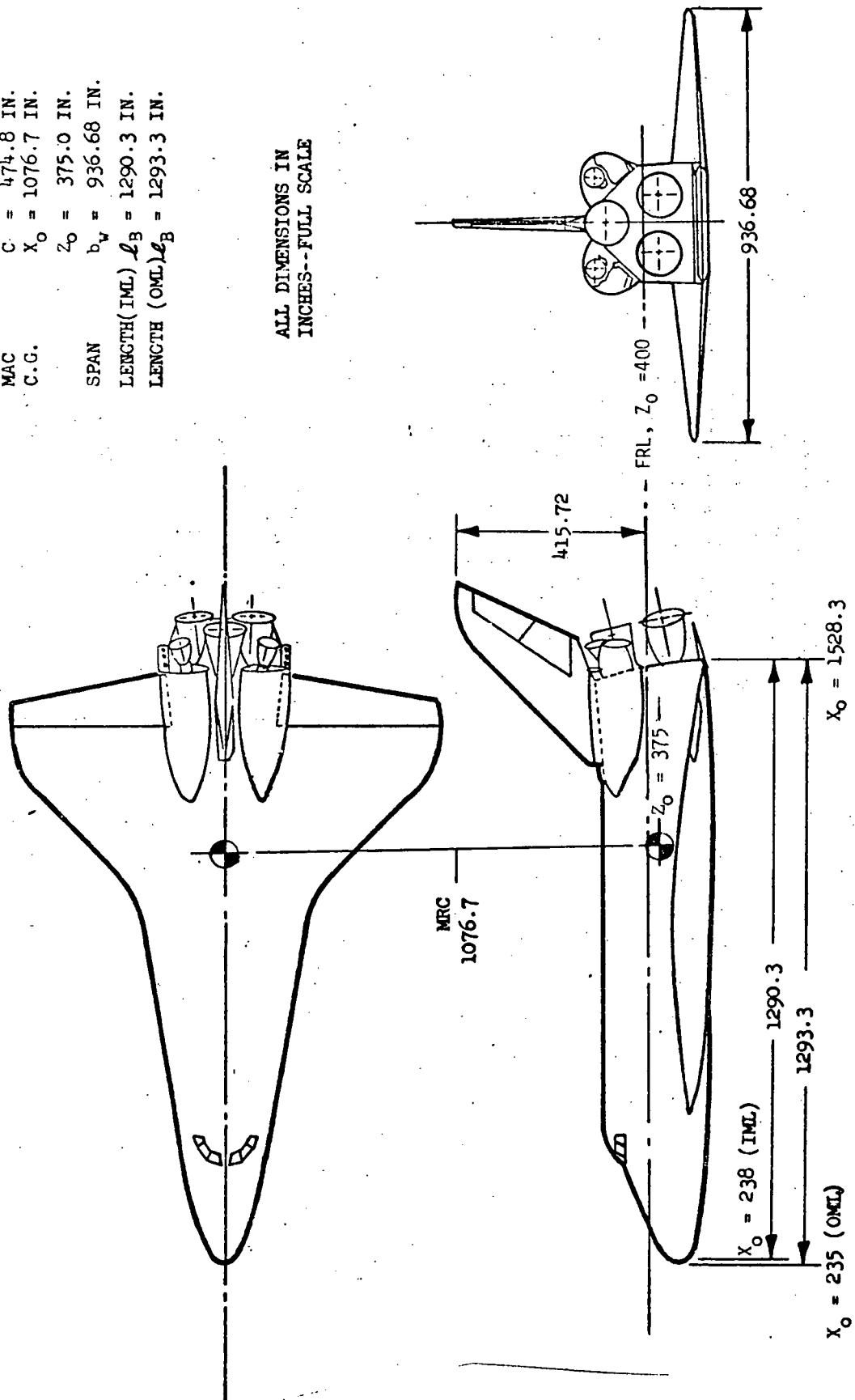


Figure 2. - Model sketch.

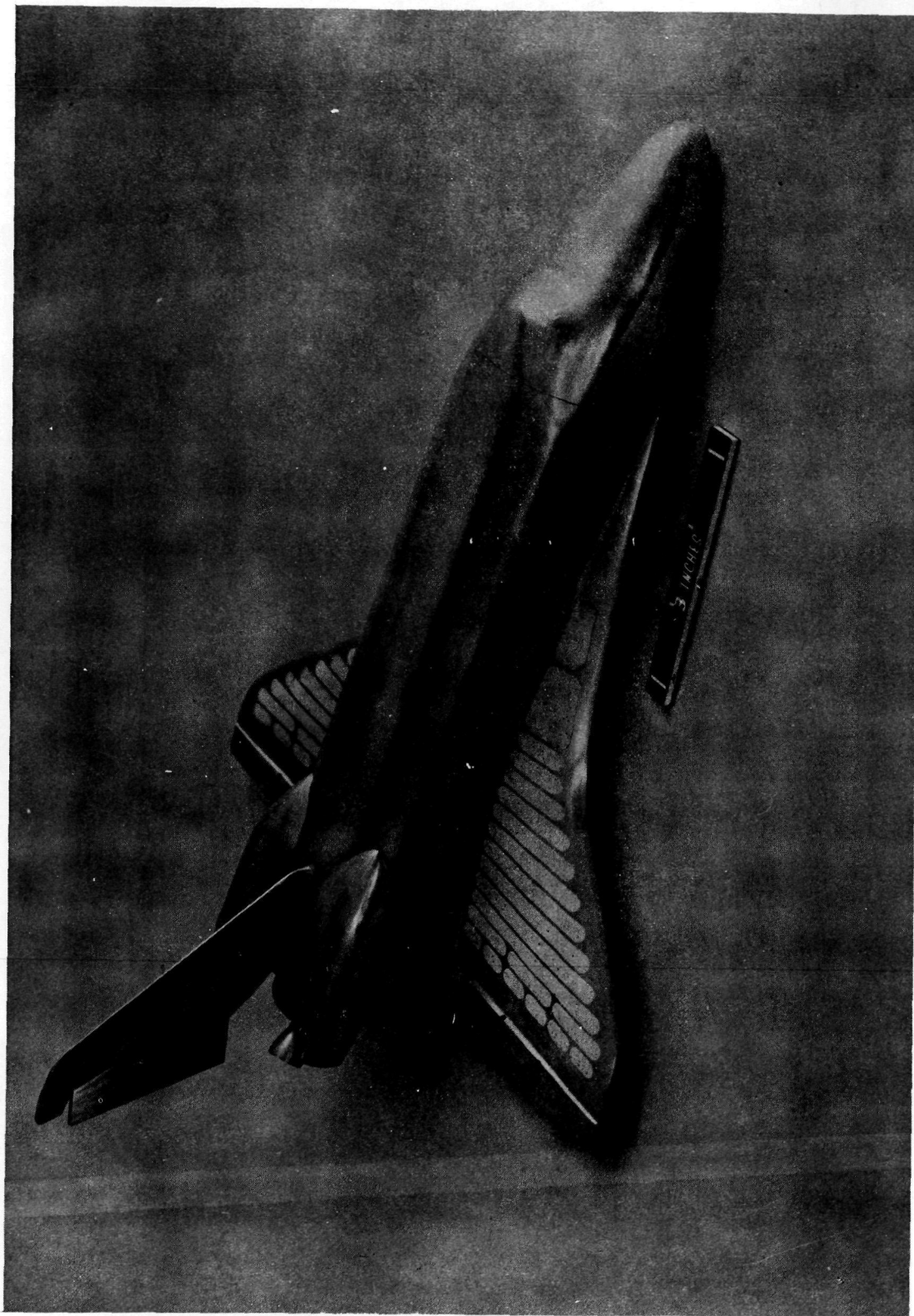


Figure 3. Model Photograph

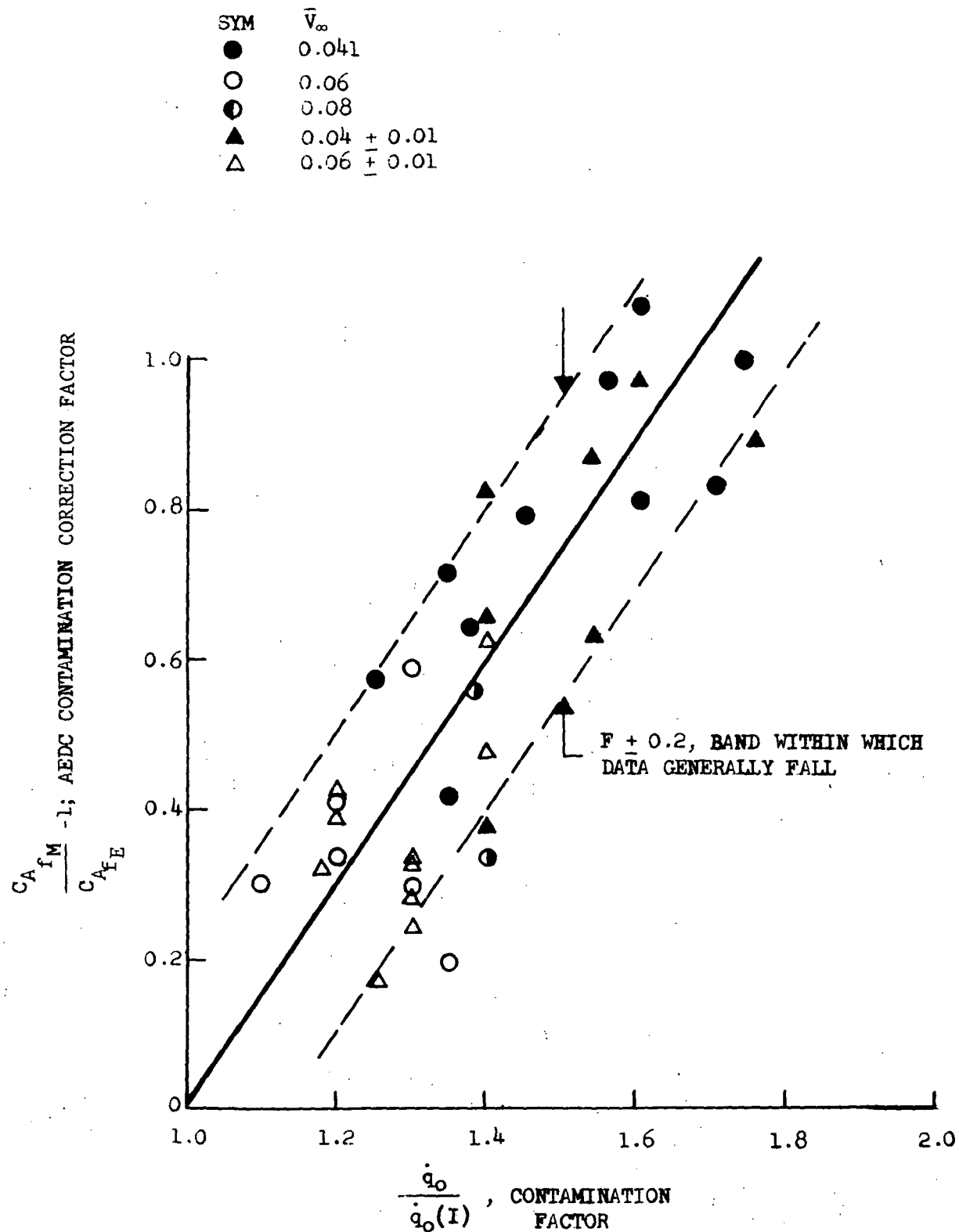


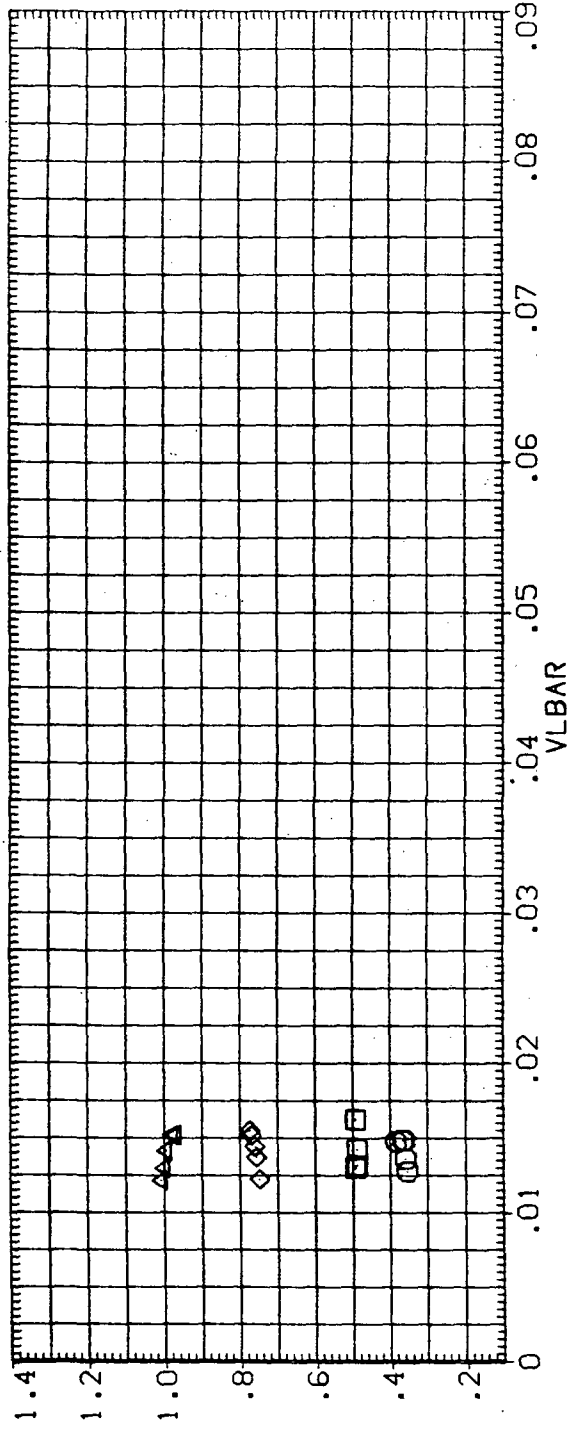
Figure 4. - AEDC Contamination Correction Factor.

SYMBOL

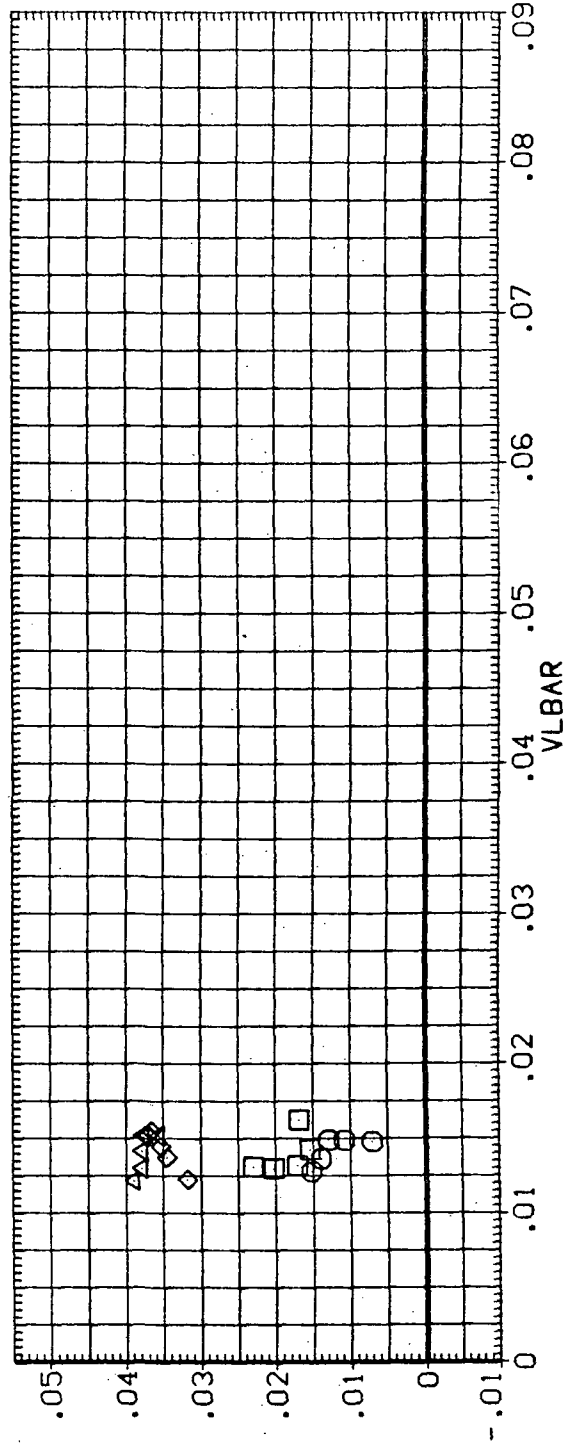
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- ◇
- △

ALPHA	BETA	PARAMETRIC VALUES	SCALE
20.000	.000	RN/L	1.100
25.000	-40.000	AILRON	.000
30.000	.000	SPOBRK	55.000
35.000	-11.700	MACH	16.000

REFERENCE INFORMATION	SCALE
SREF	2690.0000
LREF	474.8000
BREF	936.7000
XMRP	1076.7000
YMRP	.0000
ZMRP	375.0000
SCALE	.0100



CN



CLM

FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0001)

SYMBOL
 ○
 □
 ◇
 △

PARAMETRIC VALUES

ALPHA	BETA	RN/L	1.100
20.000	.000	ATLRON	.000
25.000	-40.000	SPOBRK	55.000
30.000	.000	MACH	16.000
35.000	-11.700		

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP 375.0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

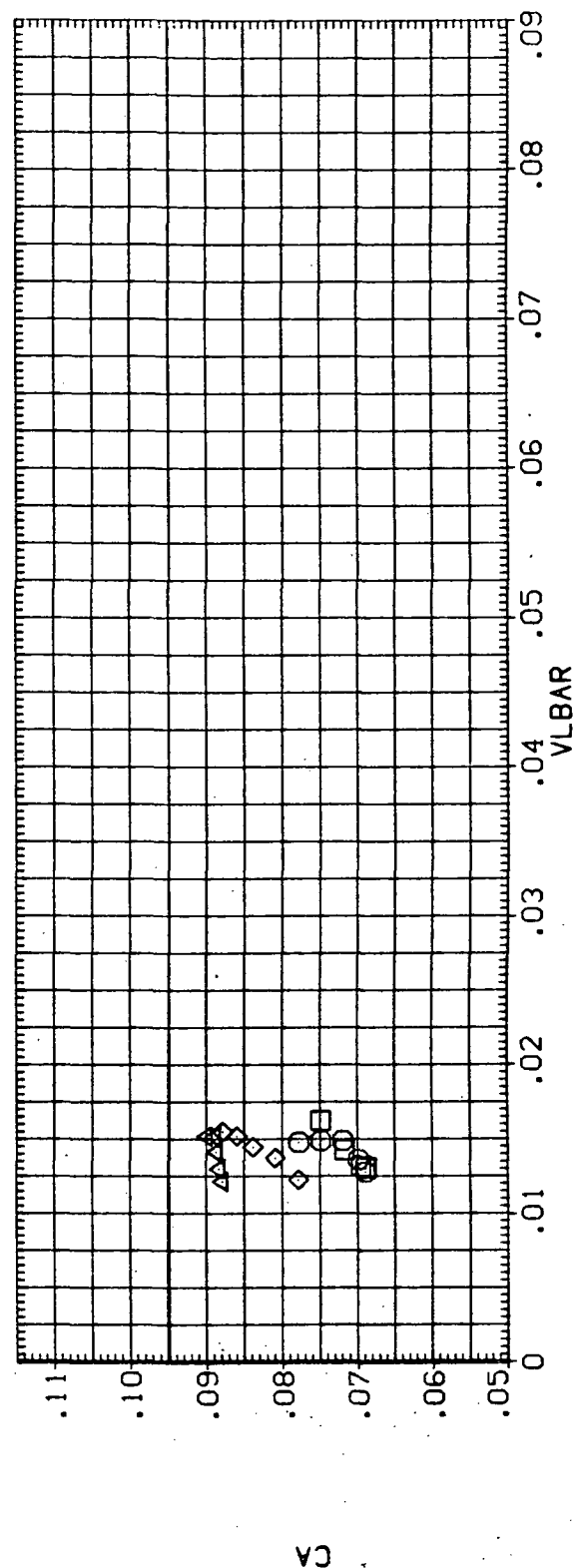
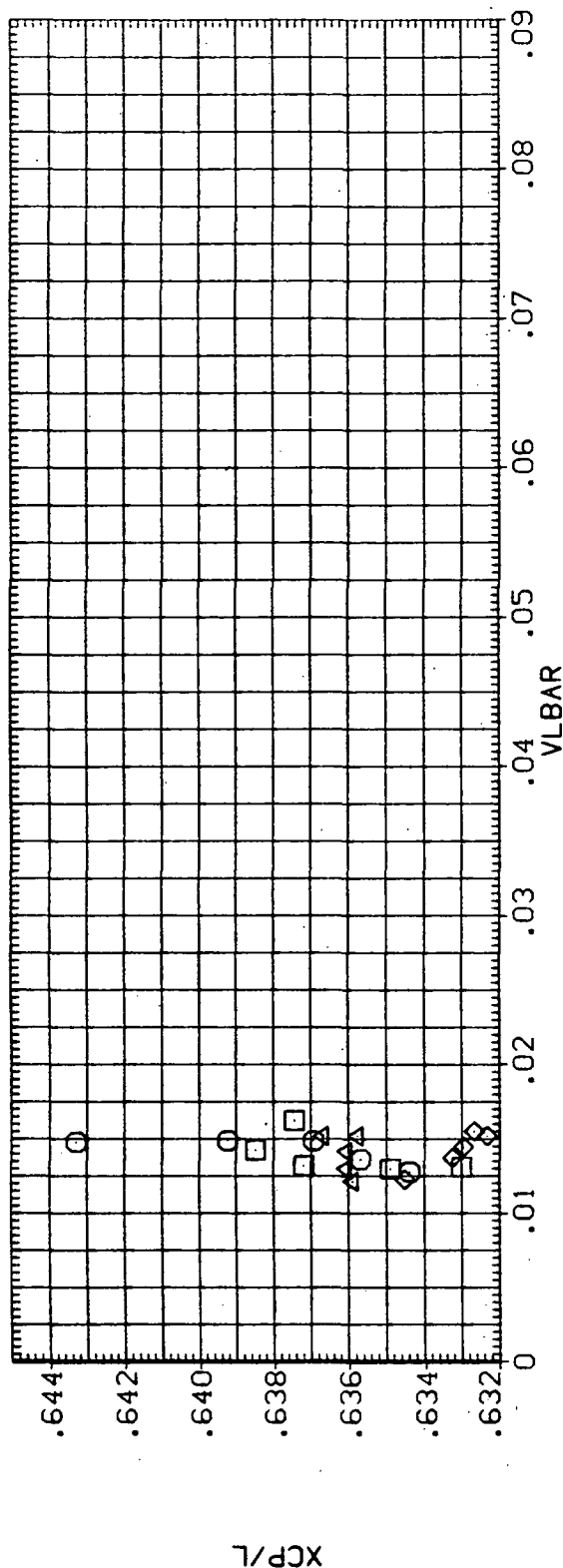


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP .0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

PARAMETRIC VALUES
 ALPHA 20.000 BETA .000 RN/L 1.100
 25.000 ELEVTR -40.000 AILRON .000
 30.000 RUDDER .000 SPDBRK 55.000
 35.000 BDFLAP -11.700 MACH 16.000

SYMBOL
 ○
 □
 ◇
 △

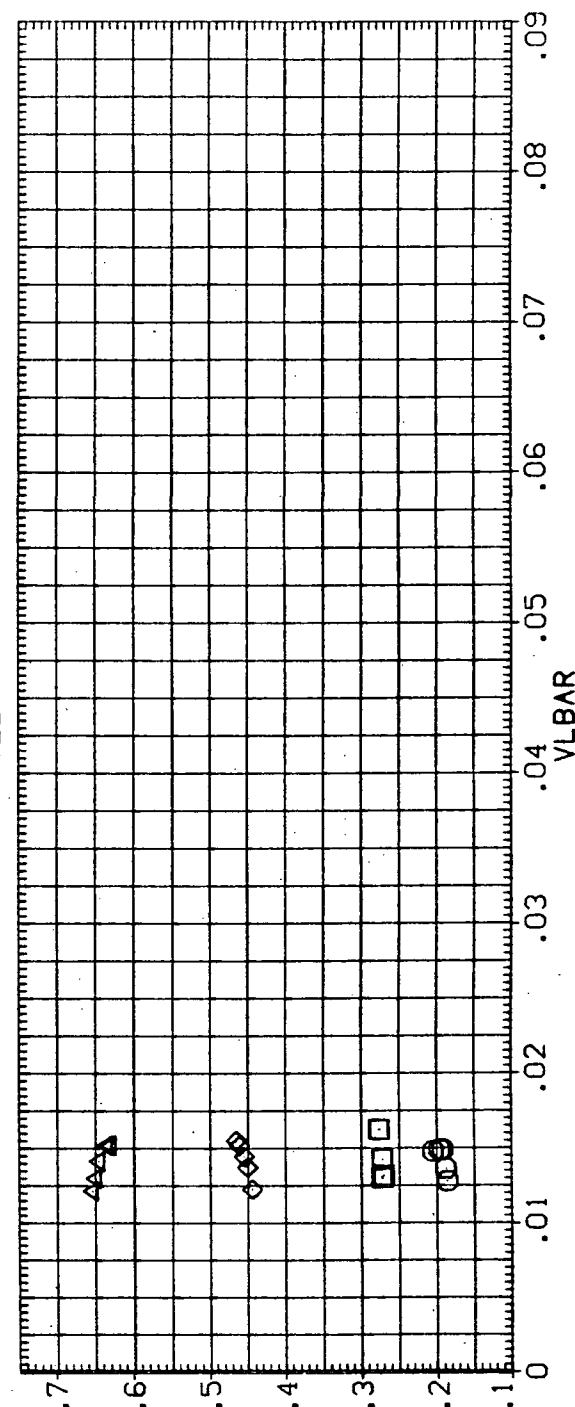
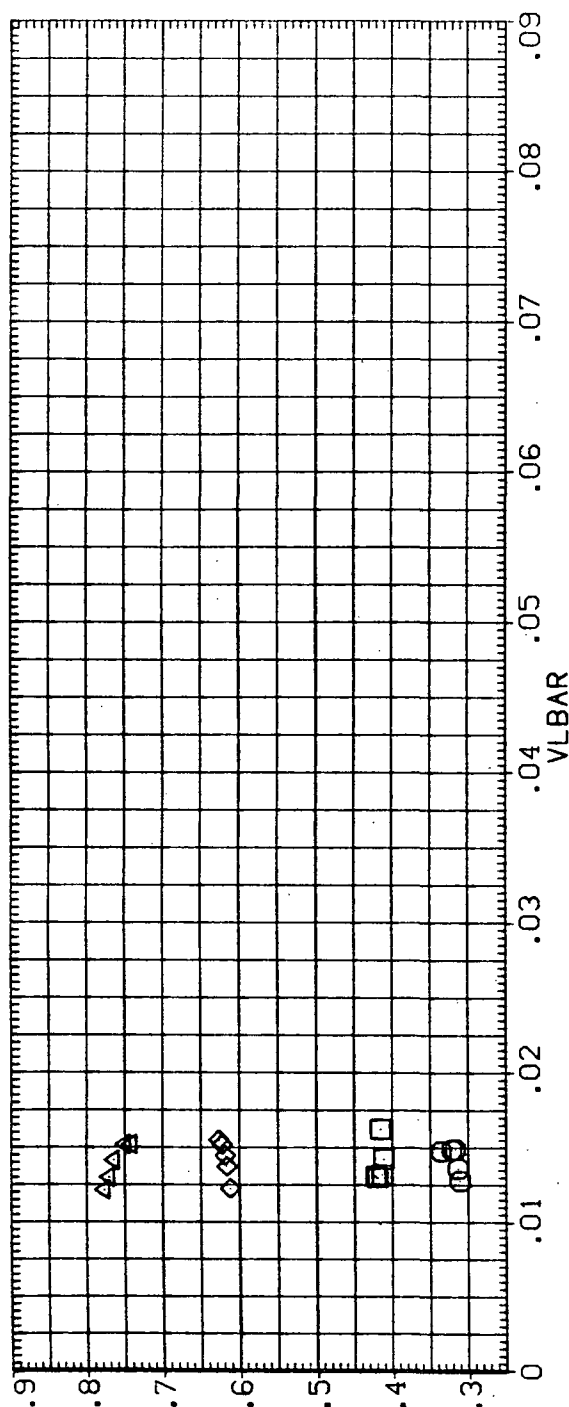


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0002)

SYMBOL
 ○ □ ◇ △

PARAMETRIC VALUES
 ALPHA 20.000 BETA .000 RN/L .250
 25.000 ELEVTR -40.000 AILRON .000
 30.000 RUDDER .000 SPDBRK 55.000
 35.000 BDFLAP -11.700 MACH 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XHRP 1076.7000 INCHES
 YHRP 375.0000 INCHES
 ZHRP .0100 INCHES
 SCALE

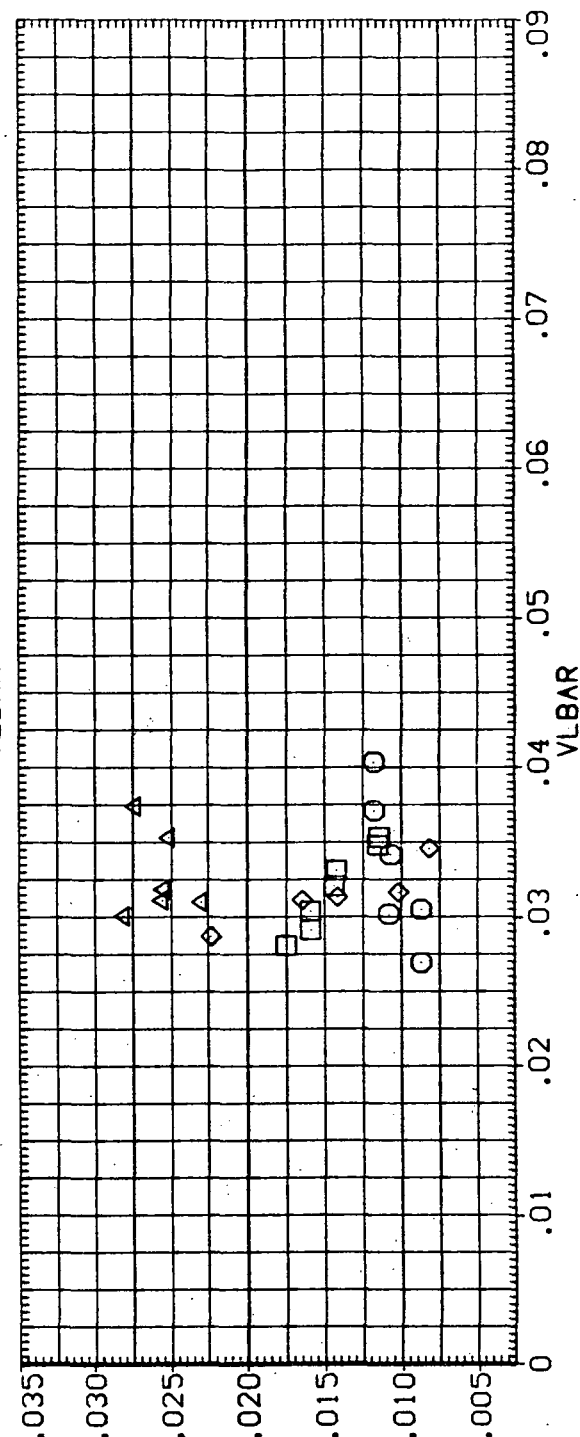
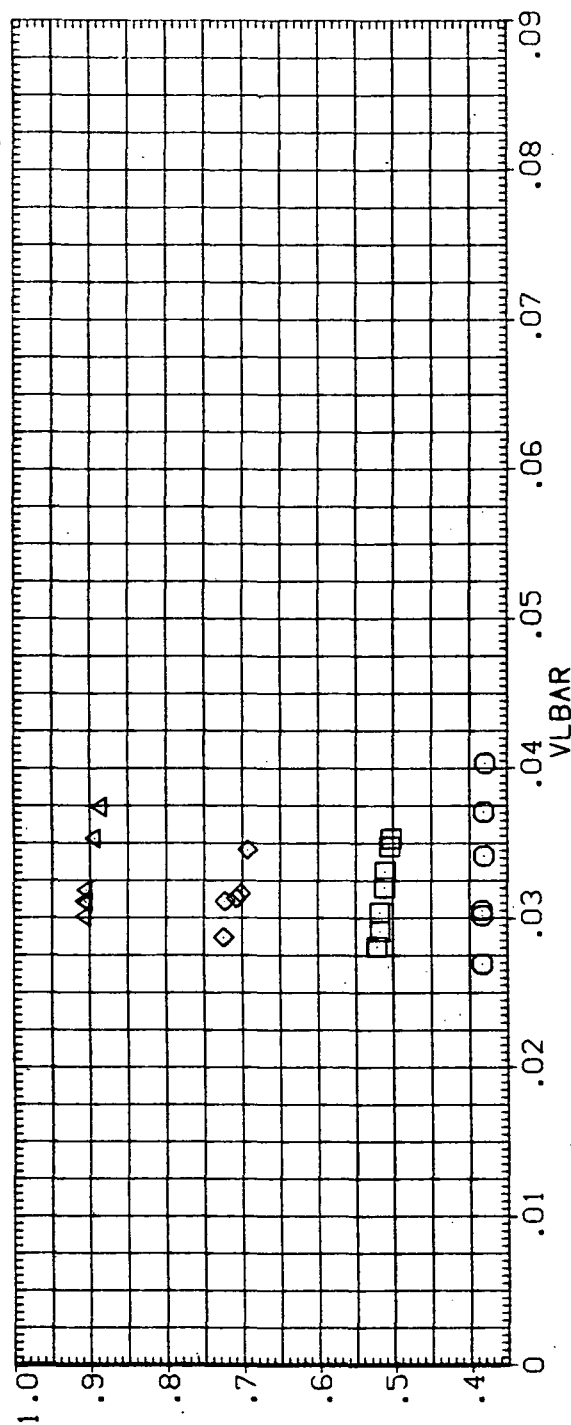


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL

ALPHA
20.000
25.000
30.000
35.000

BETA
ELEVTR
RUDDER
80FLAP

PARAMETRIC VALUES
RN/L
AILRON
SPDBRK
MACH

250
.000
-40.000
-11.700

2690.0000
474.8000
936.7000
1076.7000
375.0000
SCALE .0100

REFERENCE INFORMATION
SREF
LREF
BREF
XMRP
YMRP
ZMRP

50. FT.
INCHES
INCHES
INCHES
INCHES
INCHES

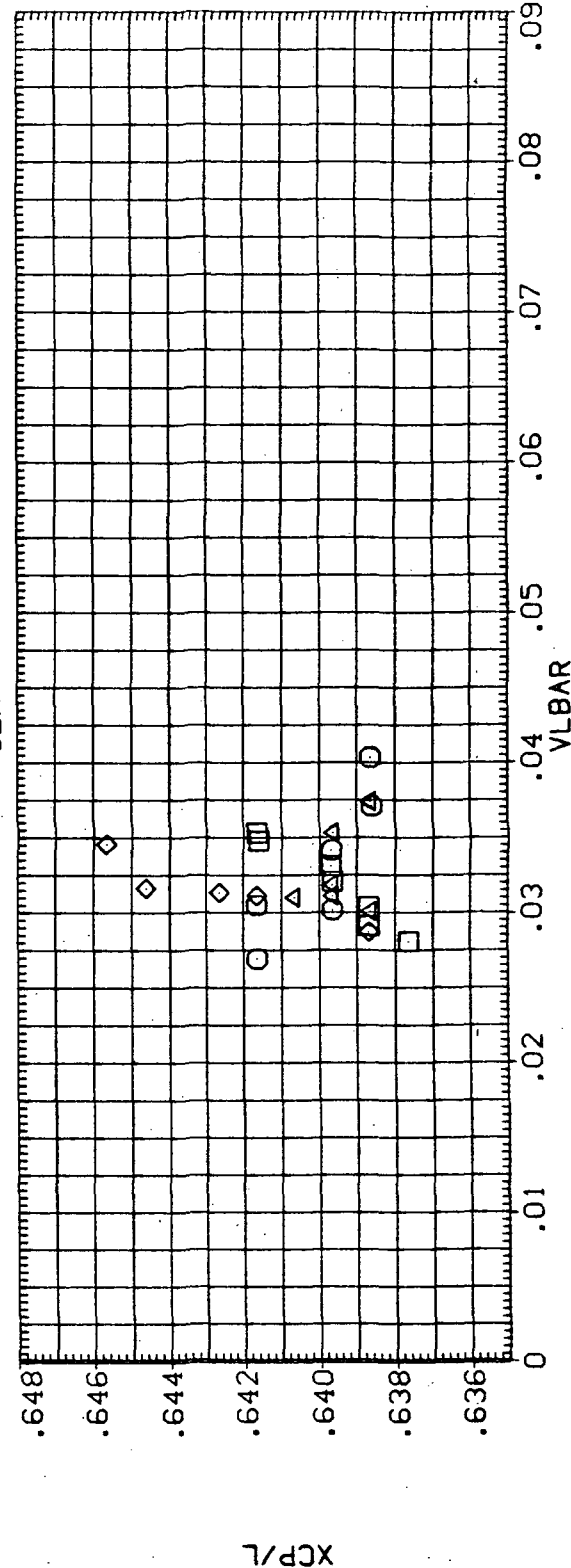
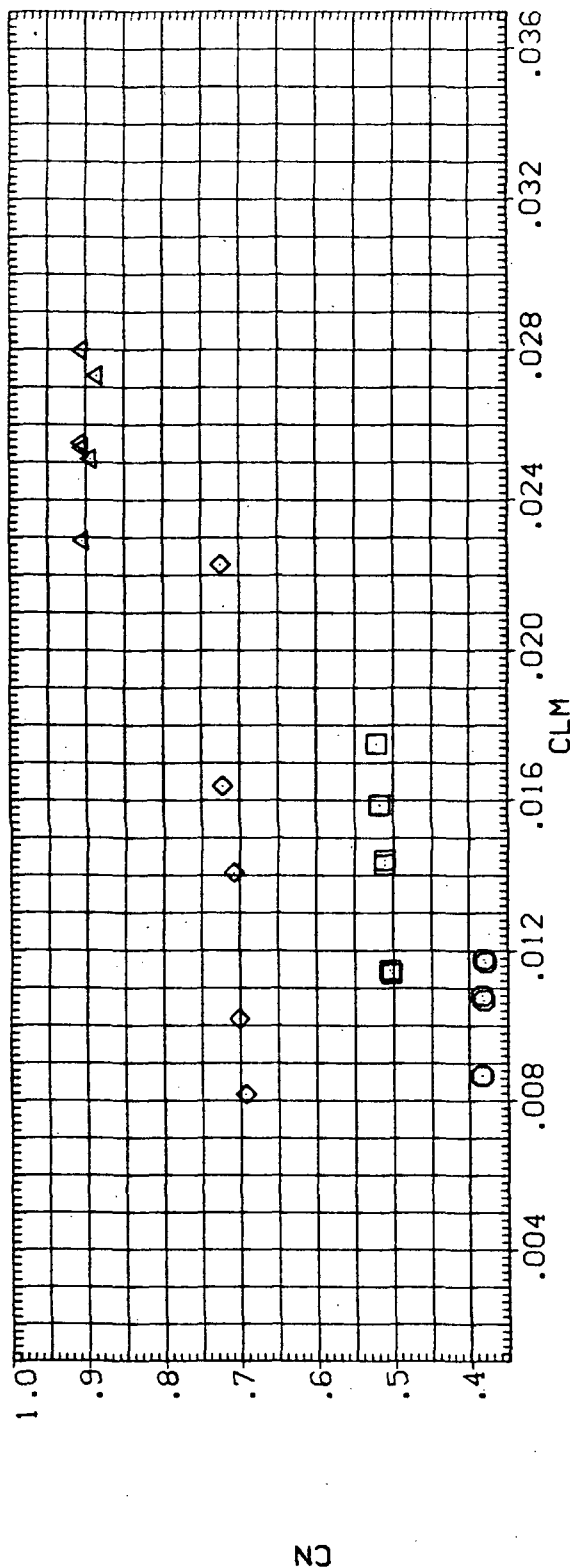


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0002)

SYMBOL
 ○
 □
 ◇
 △

PARAMETRIC VALUES
 ALPHA 20.000 BETA .000 RN/L .250
 25.000 ELEVTR -40.000 AILRON .000
 30.000 RUDDER .000 SPDBRK 55.000
 35.000 BDFLAP -11.700 MACH 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 YMRP 1076.7000 INCHES
 ZMRP .0000 INCHES
 SCALE 375.0000 INCHES
 .0100

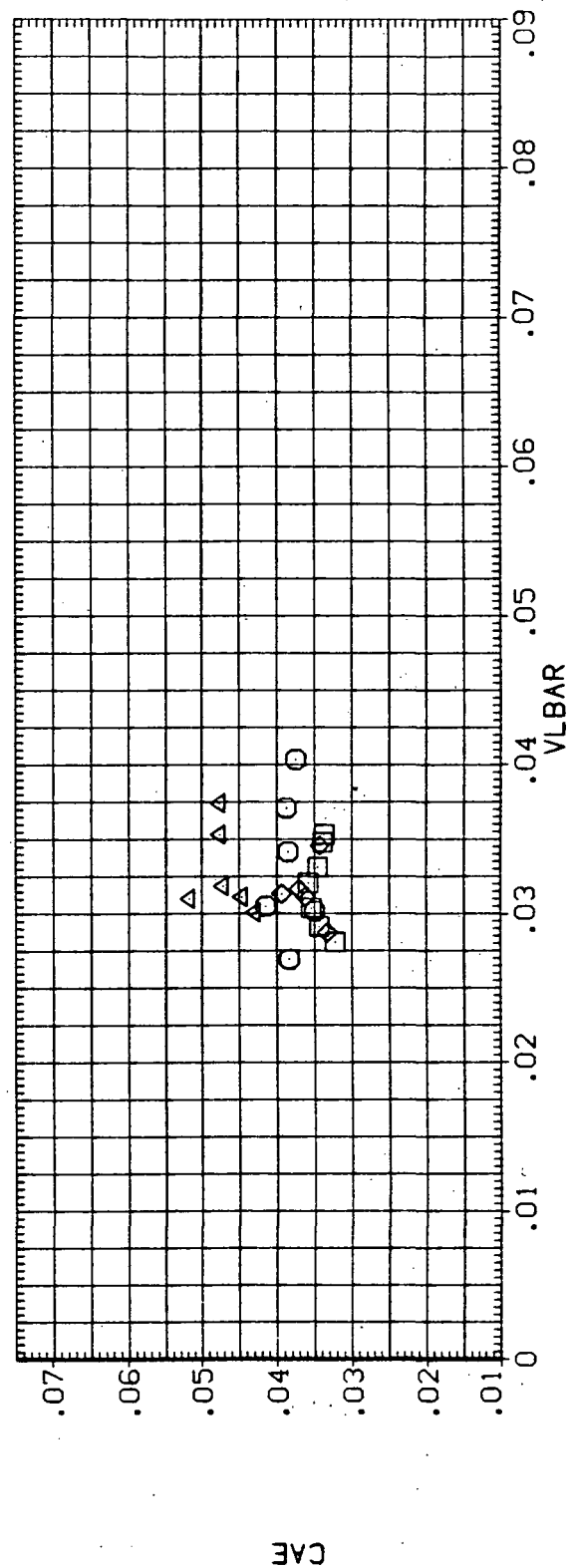
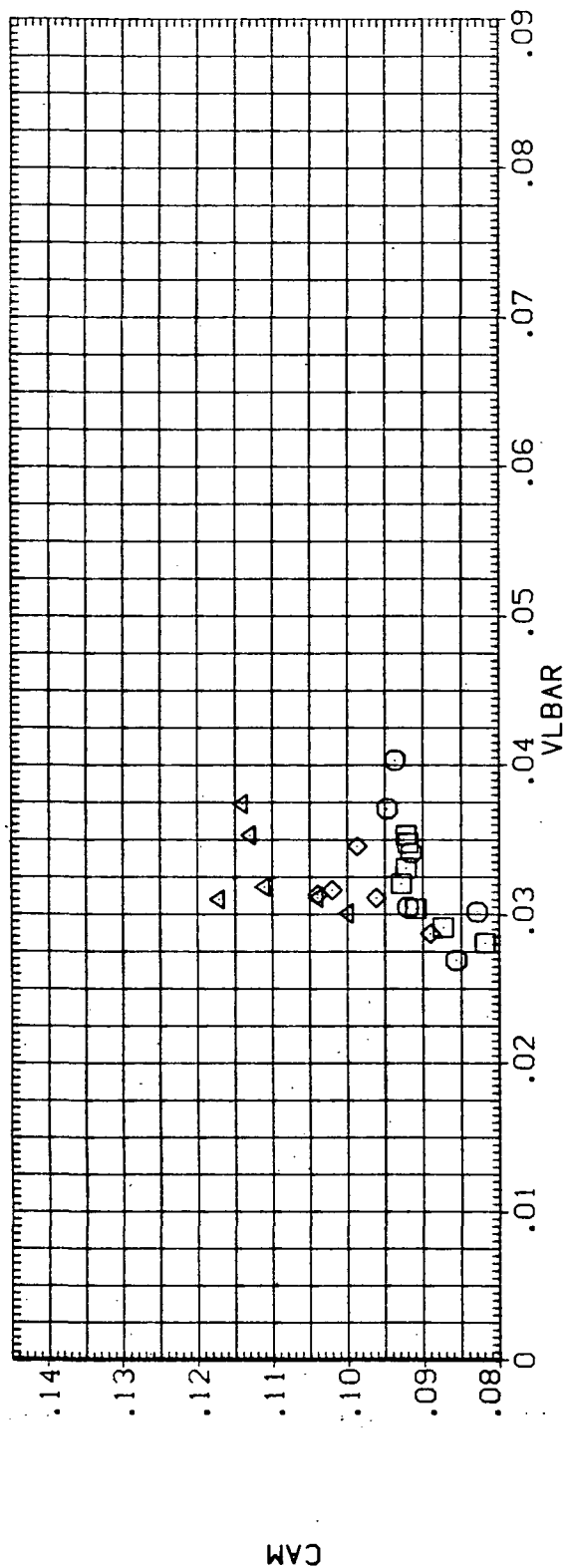


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
○ □ ◇ △

ALPHA
20.000
25.000
30.000
35.000

BETA
ELEVTR
RUDDER
BDFLAP

PARAMETRIC VALUES
RN/L
AILRON
SPOBRK
MACH

.250
.000
.000
55.000
20.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XMRP 1076.7000 INCHES
YMRP .0000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

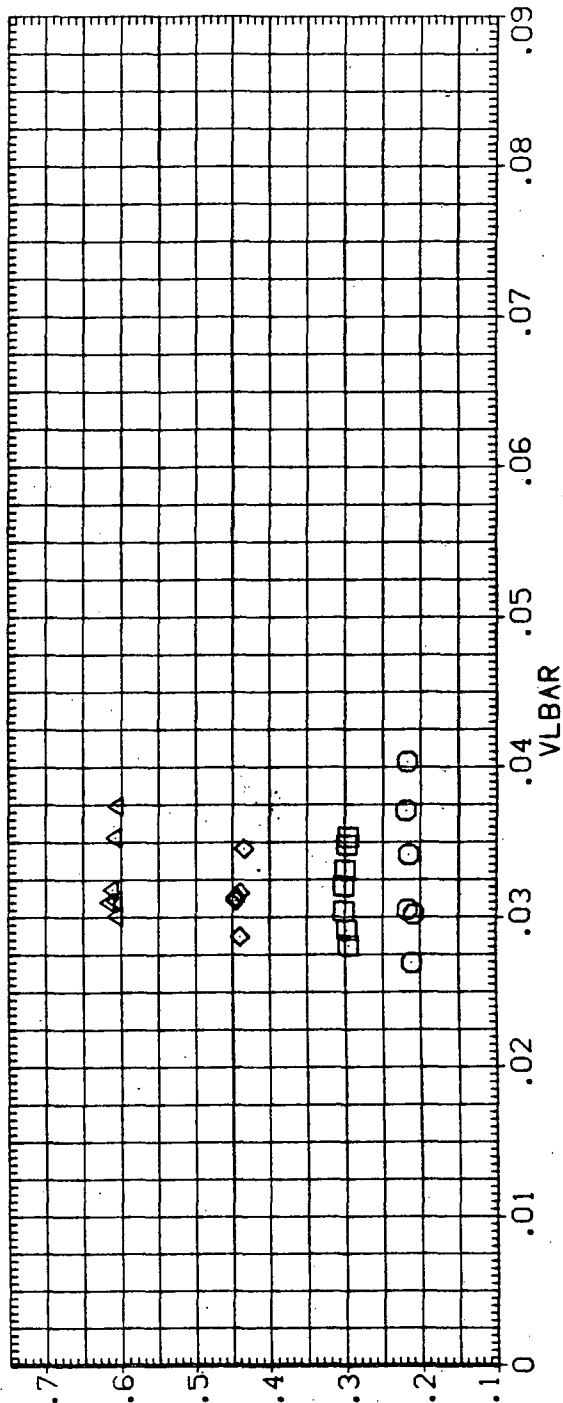
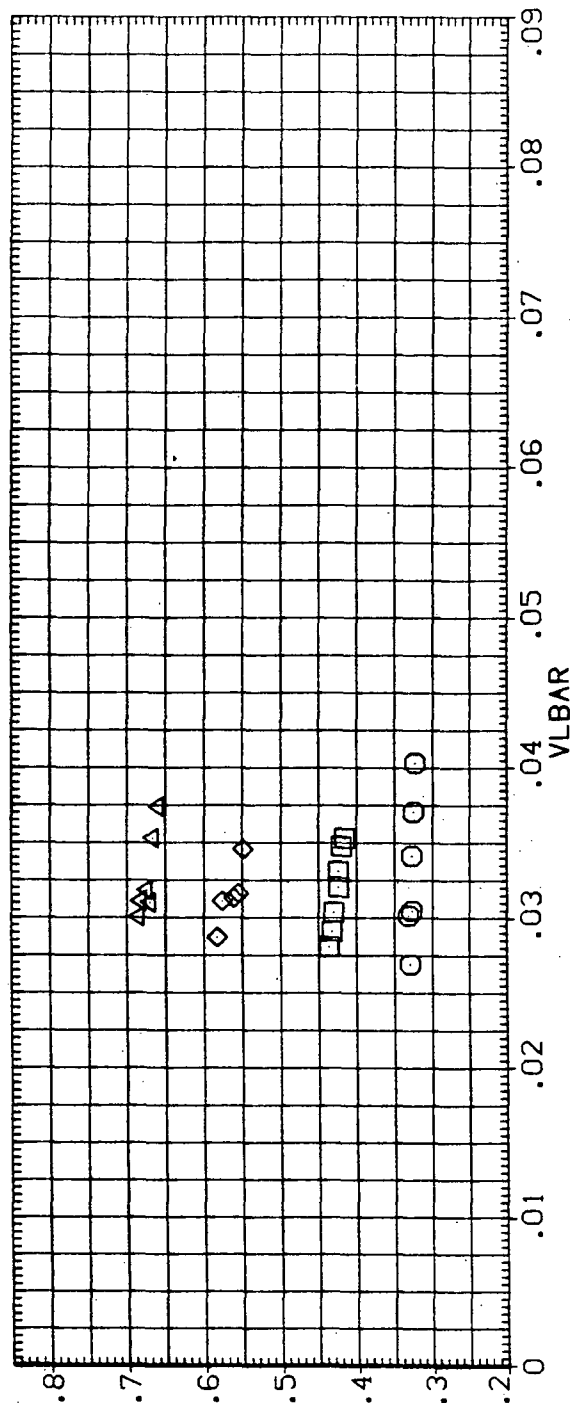


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0003)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	MACH	SREF	2690.0000	SQ.FT.	
○	25.000	.000	1.100		LREF	474.8000	INCHES	
□	30.000	.000	.000		BREF	936.7000	INCHES	
◇	35.000	.000	55.000		XMRP	1076.7000	INCHES	
		BOFLAP	-11.700	16.000	YMRP	.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

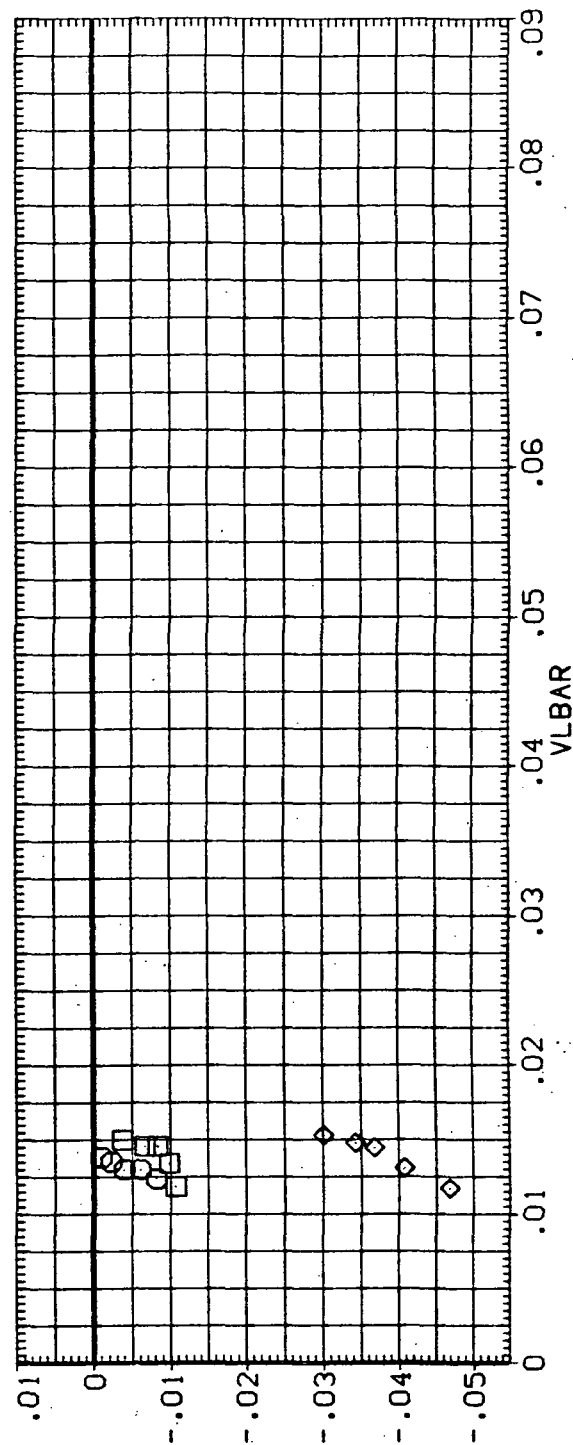
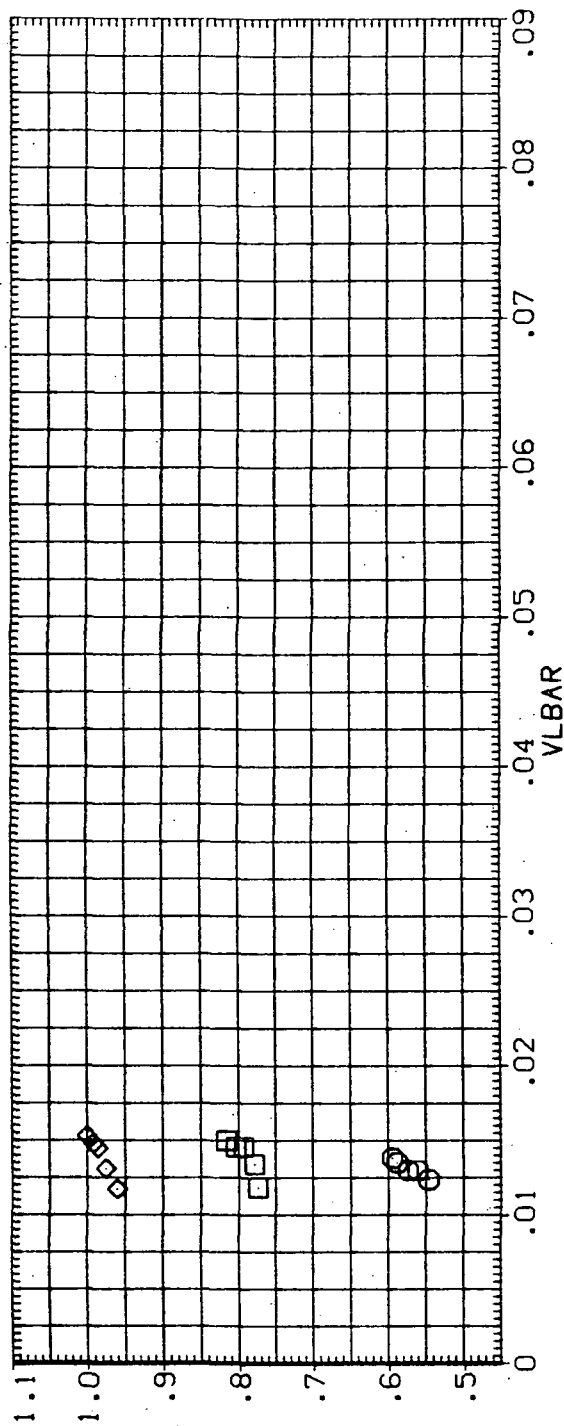


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL

ALPHA	BETA	PARAMETRIC VALUES	REFERENCE INFORMATION
25.000	.000	RN/L	SREF 2690.0000
30.000	.000	AILRON	LREF 474.8000
35.000	.000	SPDBRK	BREF 936.7000
	-11.700	MACH	XMRP 1076.7000
			YMRP .0000
			ZMRP 375.0000
			SCALE .0100

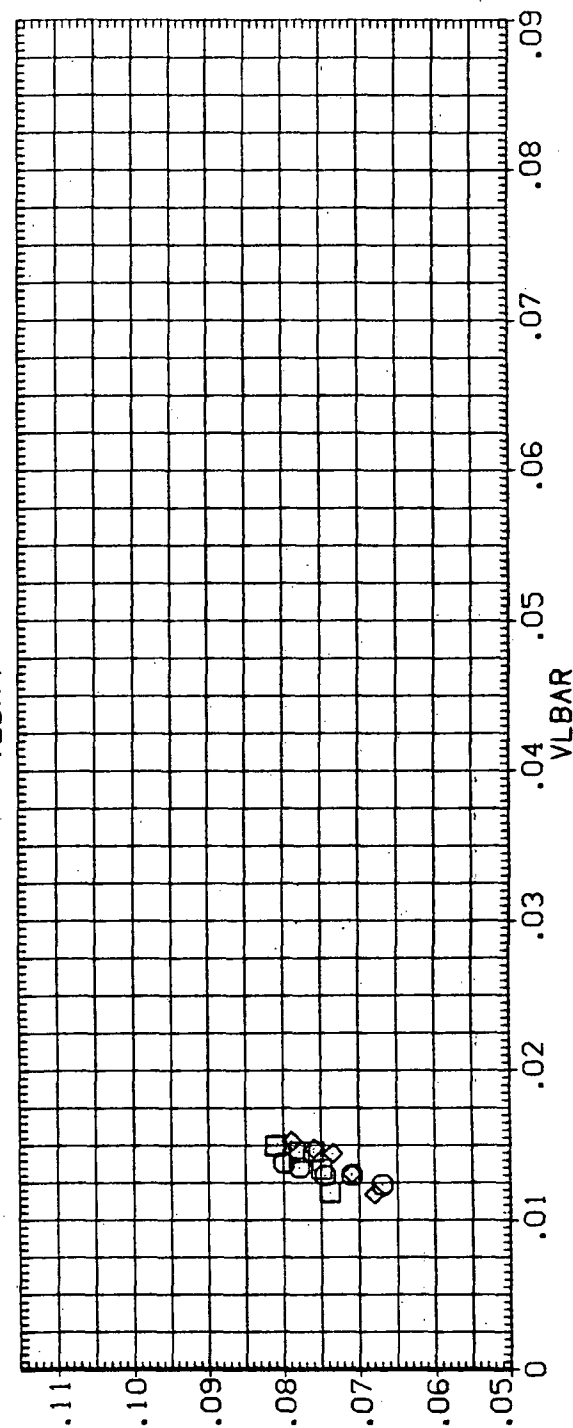
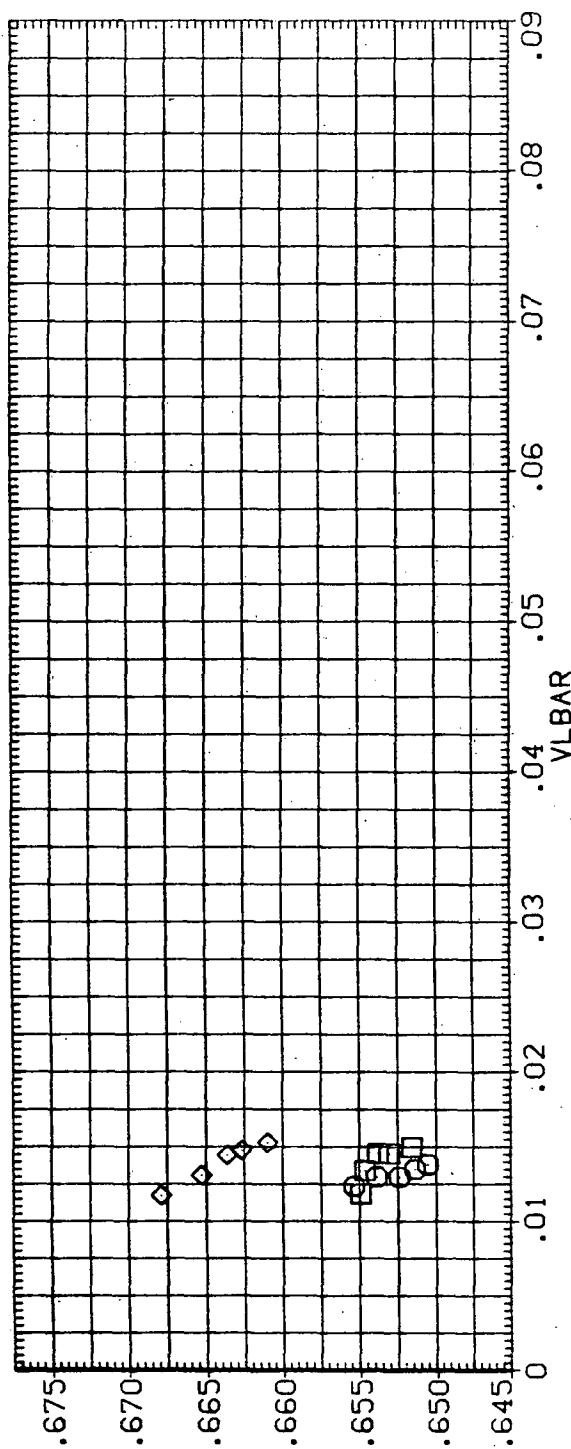








FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

REFERENCE INFORMATION	
SREF	2690.0000 SO.FT.
LREF	474.8000 INCHES
BREF	936.7000 INCHES
XMRF	1076.7000 INCHES
YMRP	.0000 INCHES
ZMRP	375.0000 INCHES
SCALE	.0100

PARAMETRIC VALUES	
.000	RN/L
.000	ATLRN
.000	SPBRK
11.700	MACH
	1.100
	.000
	55.000
	16.000

ALPHA	BETA
25.000	ELEVTR
30.000	RUDDER
35.000	BDFLAP

SYMBOL   

SYMBOL   

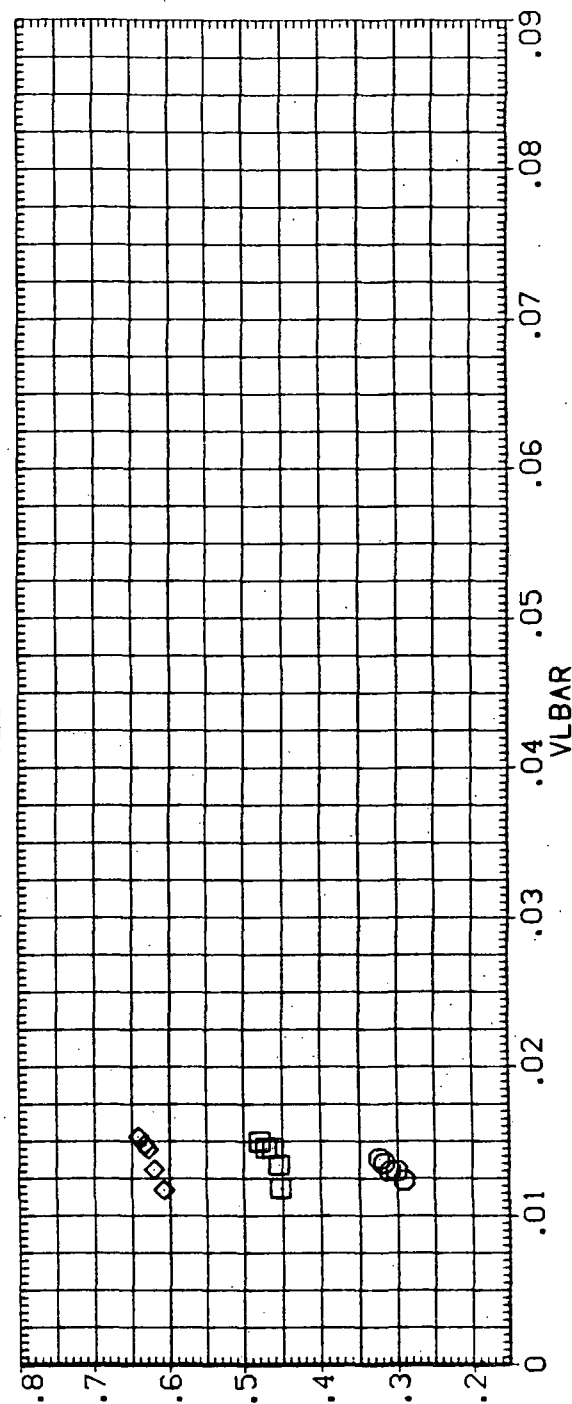
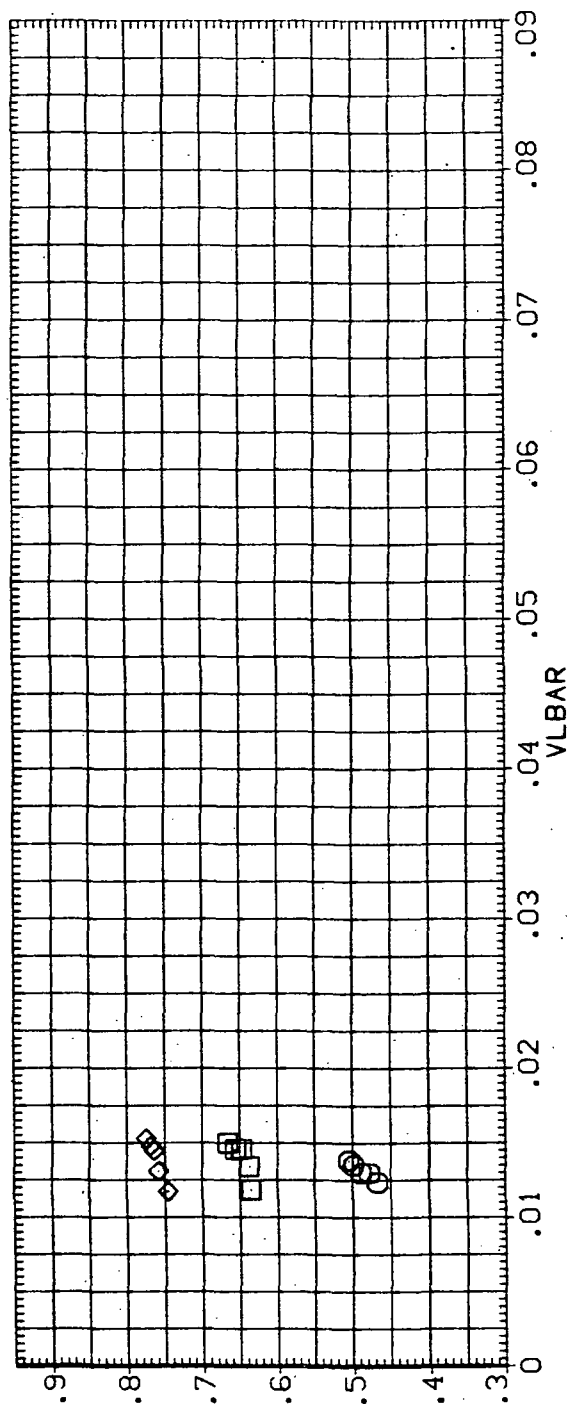


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	MACH	SREF	LREF	BREF	YMRP
○	20.000	.000	1.100	.000	2690.0000	474.8000	936.7000	375.0000
□	25.000	.000	.000	.000	INCHES	INCHES	INCHES	INCHES
◇	30.000	.000	SPDRK	55.000	INCHES	INCHES	INCHES	INCHES
△	35.000	.000	MACH	16.000	INCHES	INCHES	INCHES	INCHES
					SCALE			

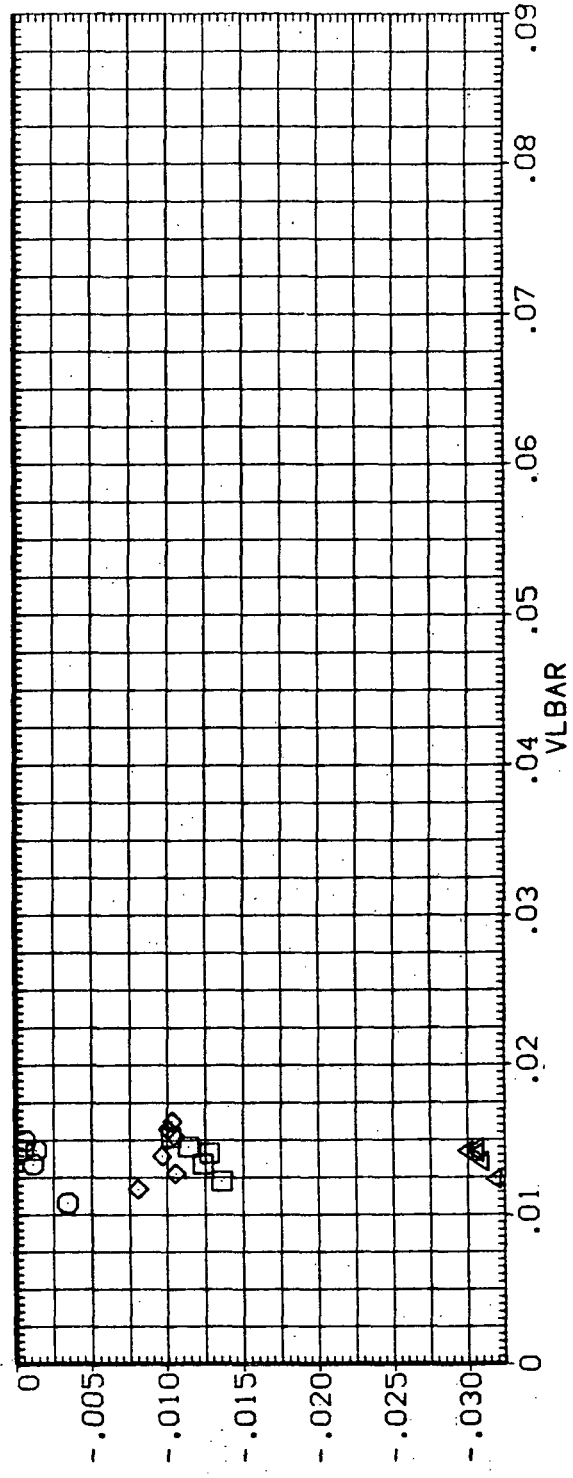
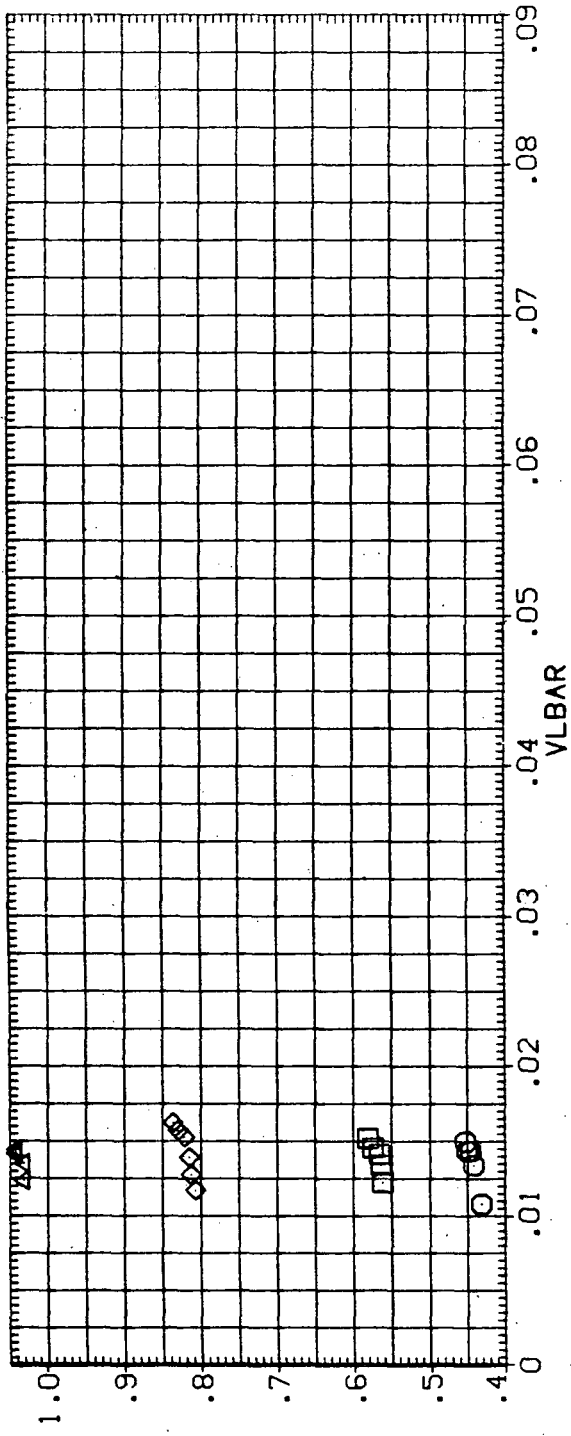


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0004)

PARAMETRIC VALUES		REFERENCE INFORMATION	
ALPHA	BETA	SREF	2690.0000
20.000	.000	LREF	474.8000
25.000	.000	BREF	936.7000
30.000	.000	YMRP	1076.7000
35.000	.000	ZMRP	.0000
		SCALE	375.0000
			.0100

SYMBOL
 □
 ◇
 △

RN/L 1.100
 AILRON .000
 SPOBRK 55.000
 MACH 16.000

ELEVTR .000
 RUDDER .000
 BDFLAP .000

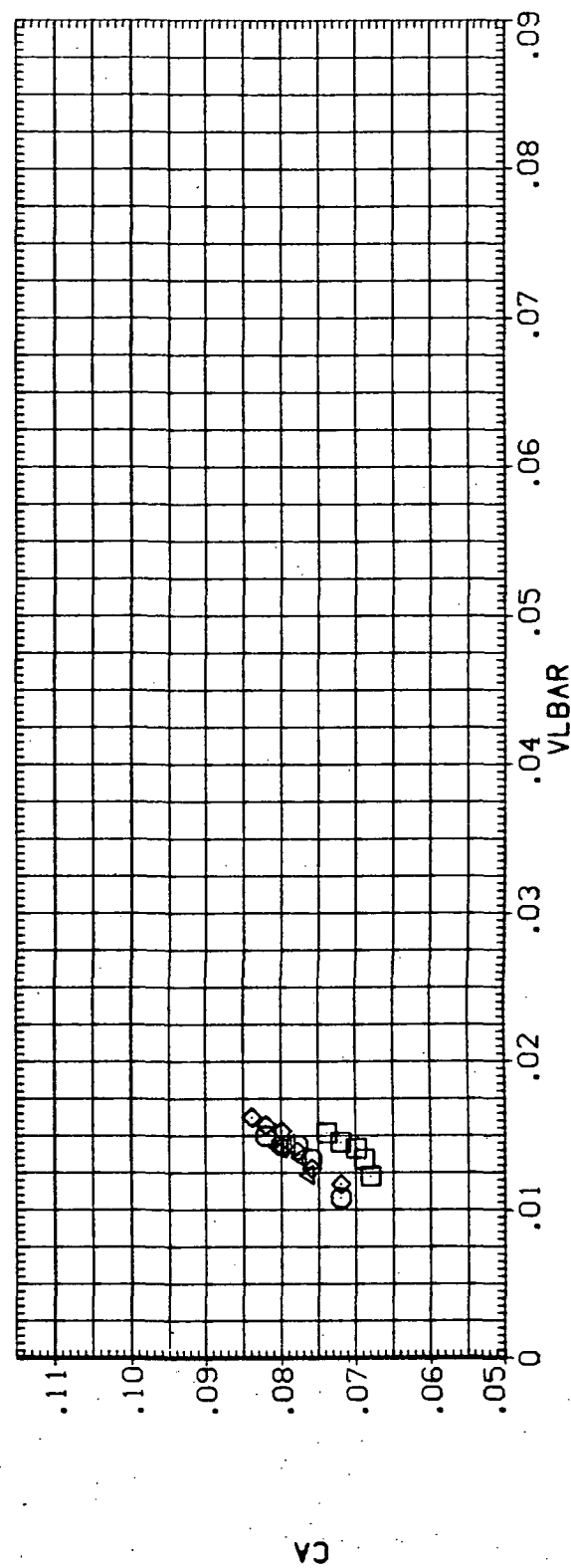
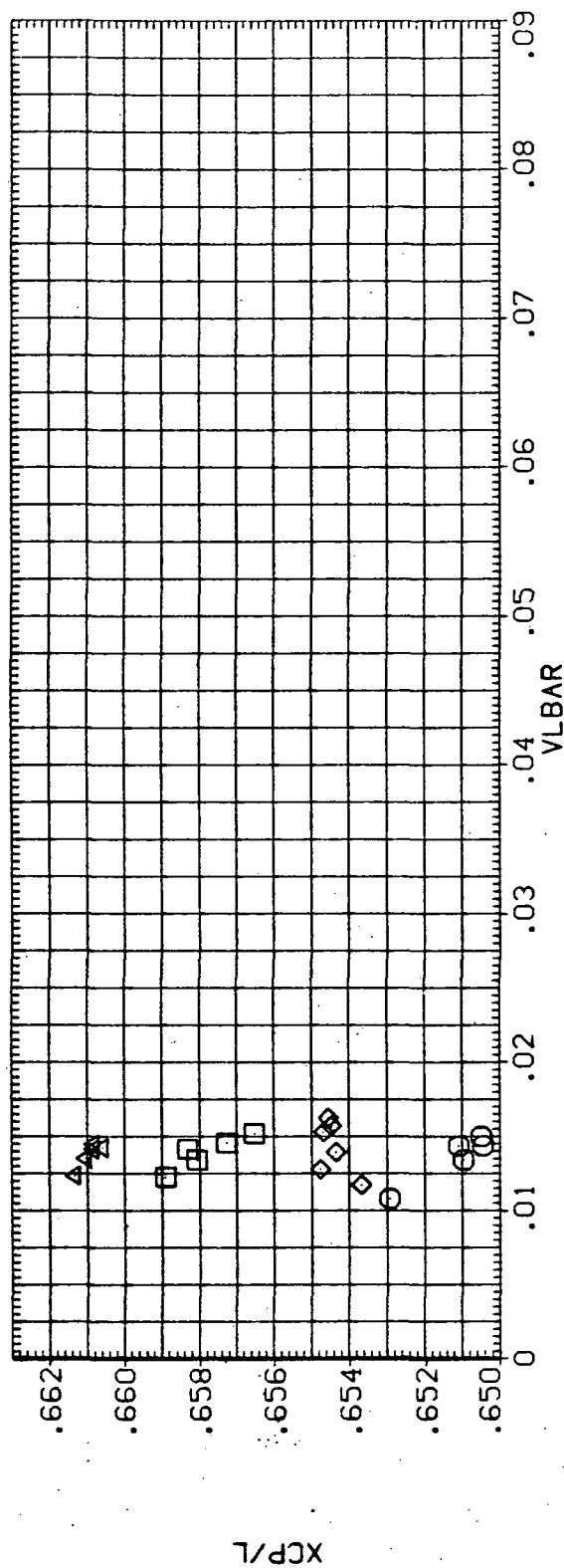


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL ALPHA BETA PARAMETRIC VALUES

○	20.000		.000	RN/L	1.100
□	25.000	ELEVTR	.000	AILRON	.000
◇	30.000	RUDDER	.000	SPDBRK	55.000
△	35.000	BDFLAP	.000	MACH	16.000

REFERENCE INFORMATION

SREF	2690.0000	SO.FT.
LREF	474.8000	INCHES
BREF	936.7000	INCHES
XHRP	1076.7000	INCHES
YHRP	.0000	INCHES
ZHRP	375.0000	INCHES
SCALE	.0100	

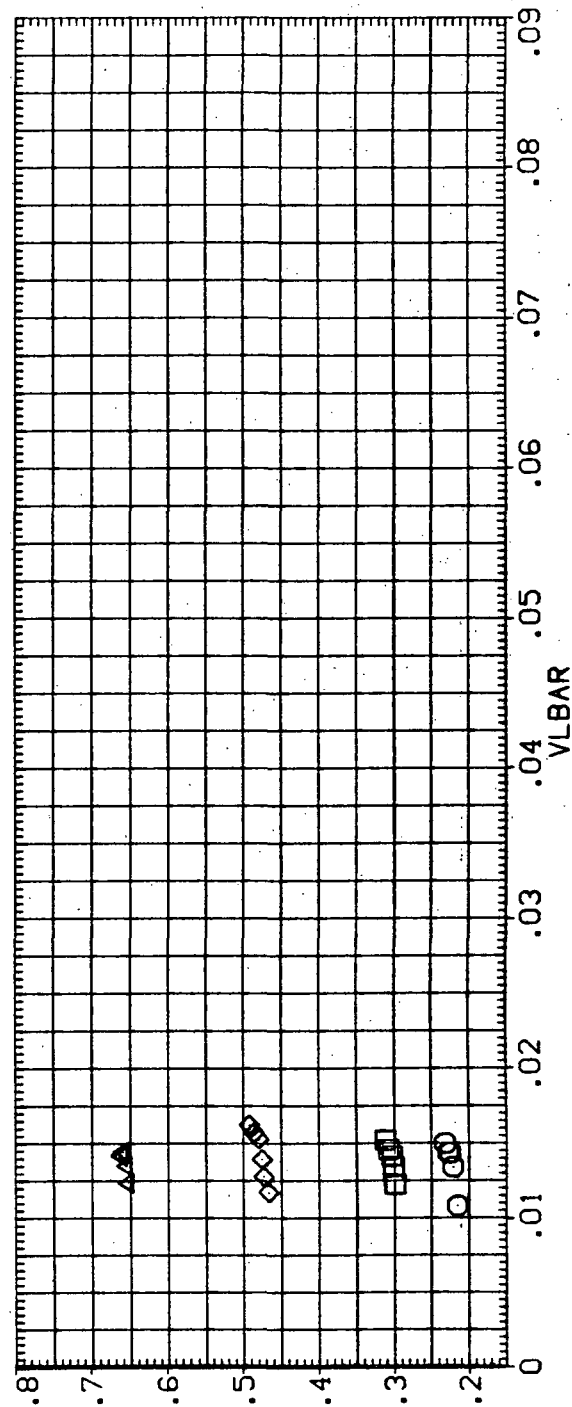
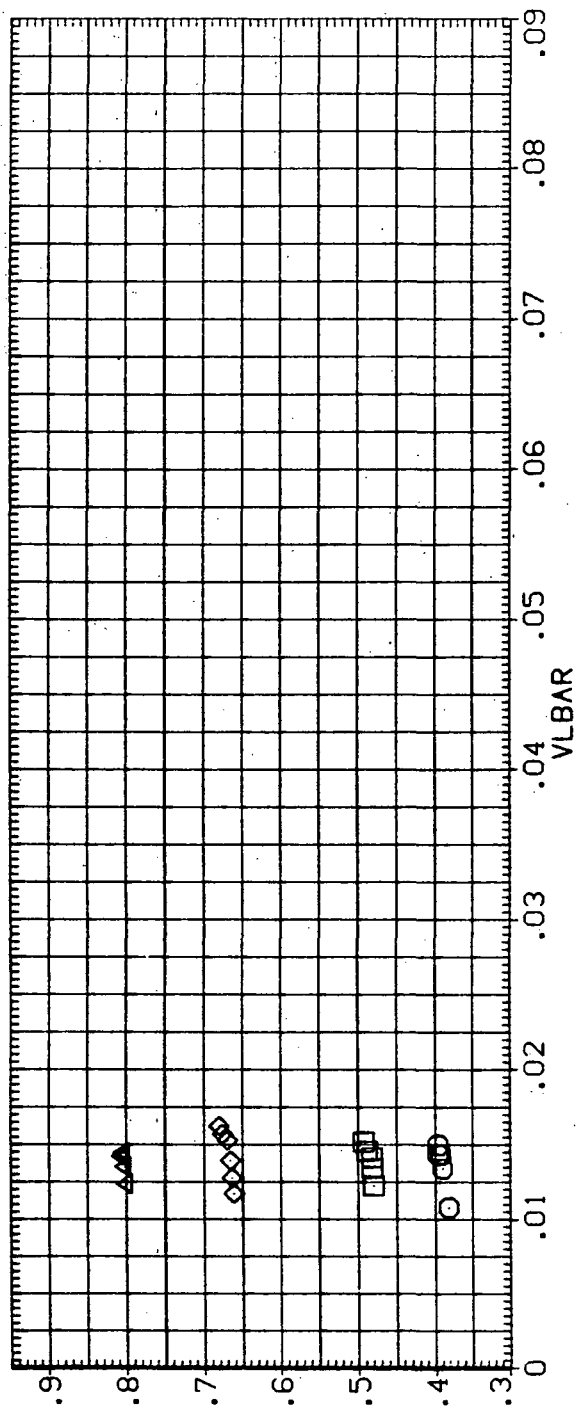


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0005)

SYMBOL		PARAMETRIC VALUES	
○	BETA	.000	RN/L
□	ELEVTR	.000	AILRON
◇	RUDDER	.000	SPOBRK
△	BDFLAP	.000	MACH

REFERENCE INFORMATION	
SREF	2690.0000
LREF	474.8000
BREF	936.7000
YMRP	1076.7000
ZMRP	.0000
SCALE	.0100

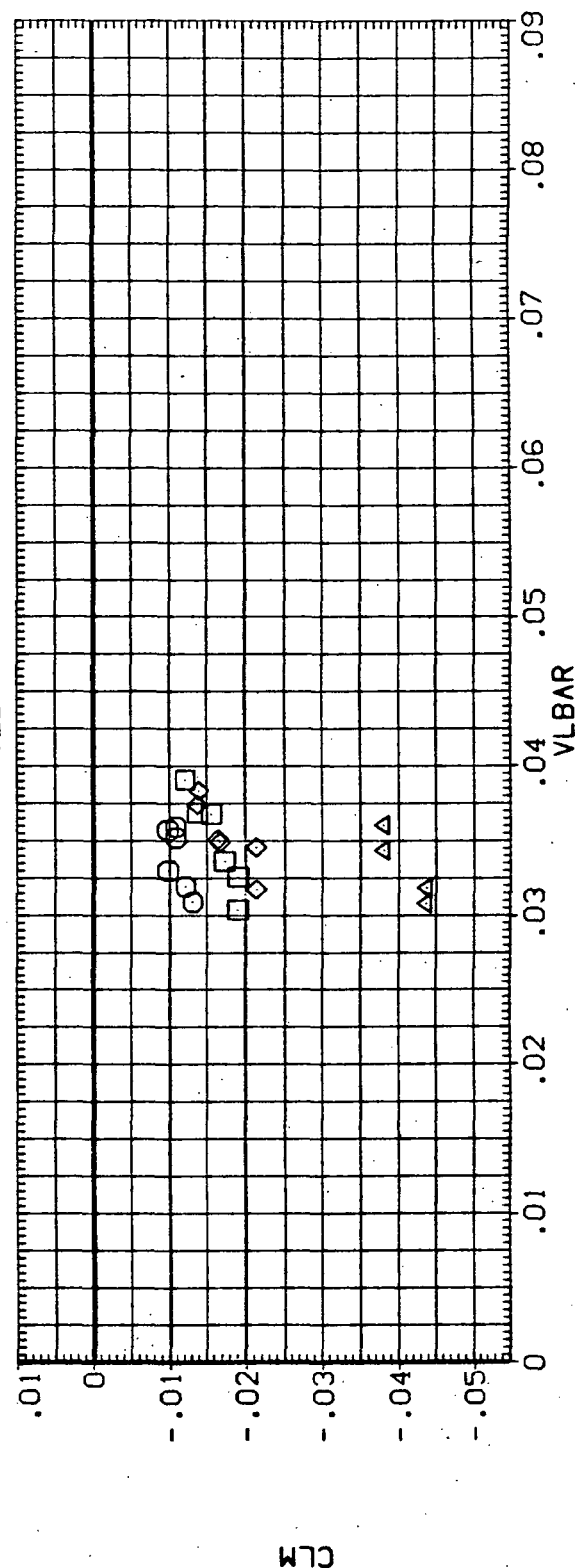
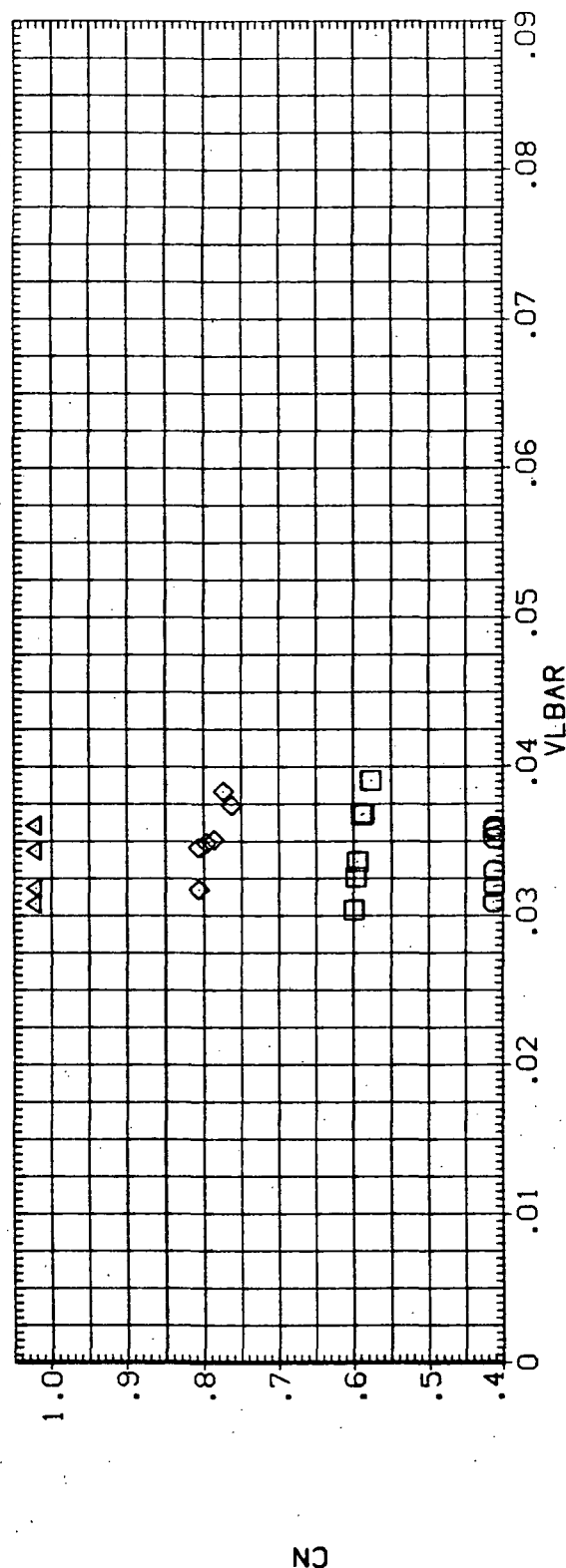


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL ALPHA BETA ELEVTR RUDDER BOFLAP
 20.000 .000 RN/L
 25.000 .000 AILRON
 30.000 .000 SPOBRK
 35.000 .000 MACH

PARAMETRIC VALUES
 .250
 .000
 55.000
 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 YMRP 1076.7000 INCHES
 ZMRP .0000 INCHES
 SCALE .0100

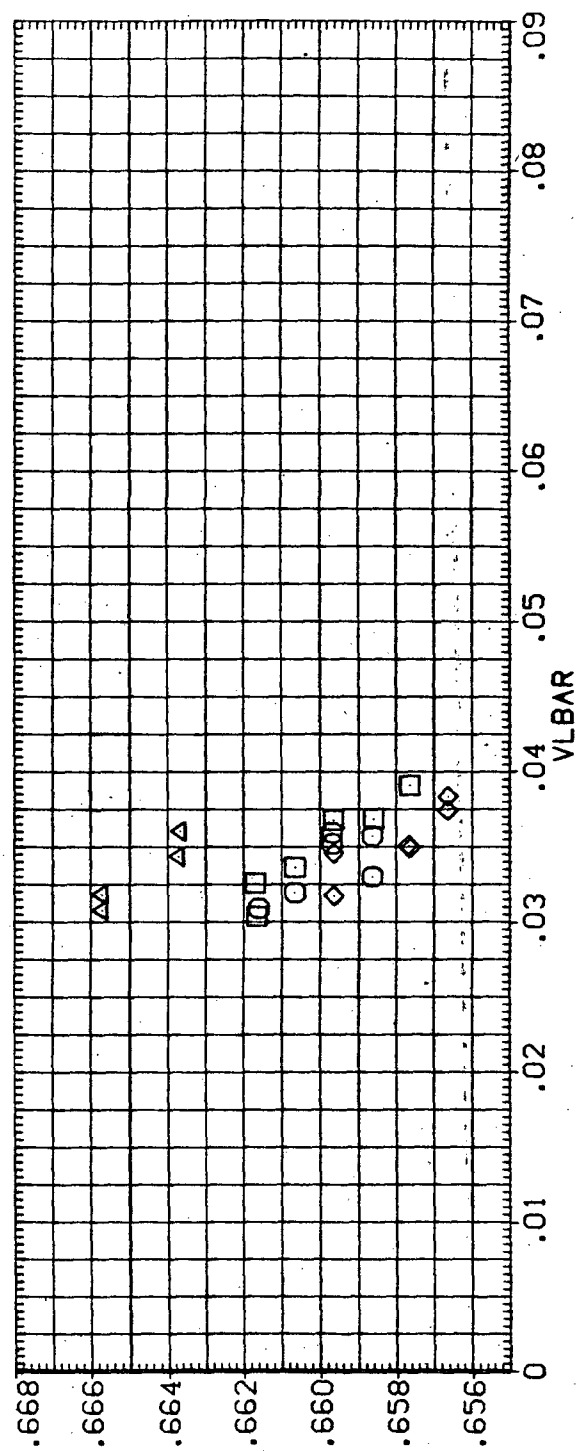
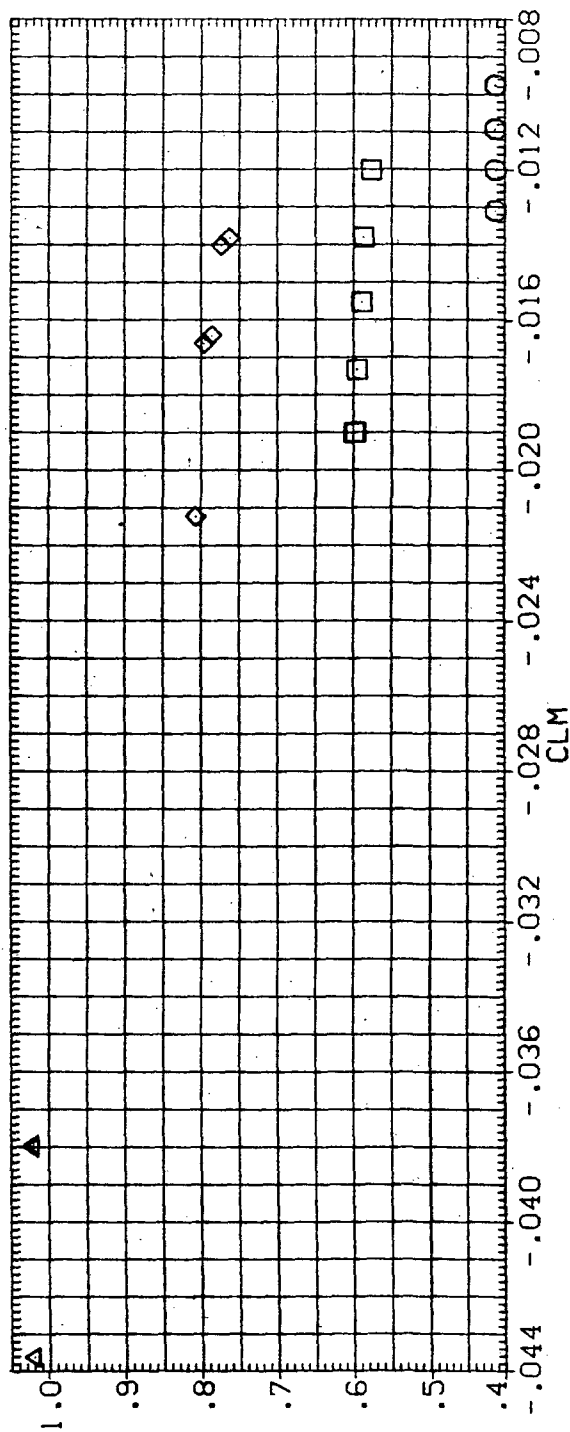


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0005)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	SCALE	SREF	LREF	BREF	YMRP
○	20.000	.000	.250		2690.0000	474.8000	936.7000	375.0000
□	25.000	.000	.000		474.8000	936.7000	375.0000	0.100
◇	30.000	.000	55.000		1076.7000	1076.7000	1076.7000	1076.7000
△	35.000	.000	20.000		375.0000	375.0000	375.0000	375.0000

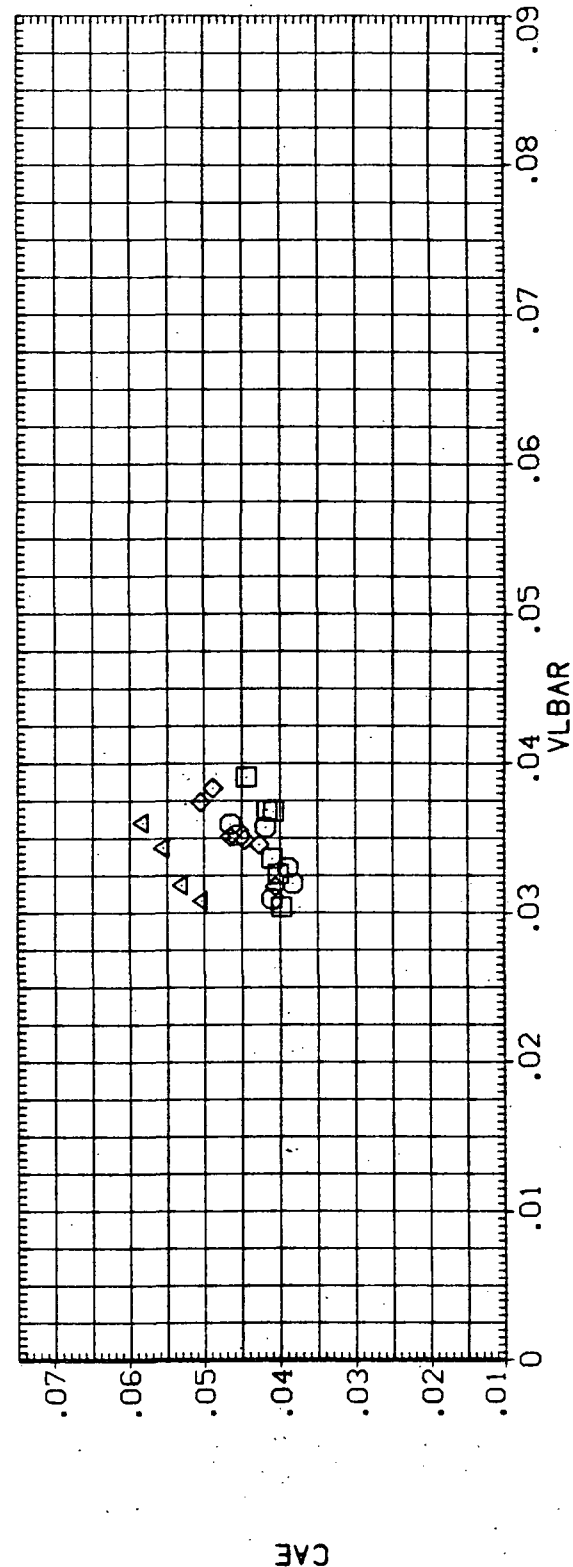
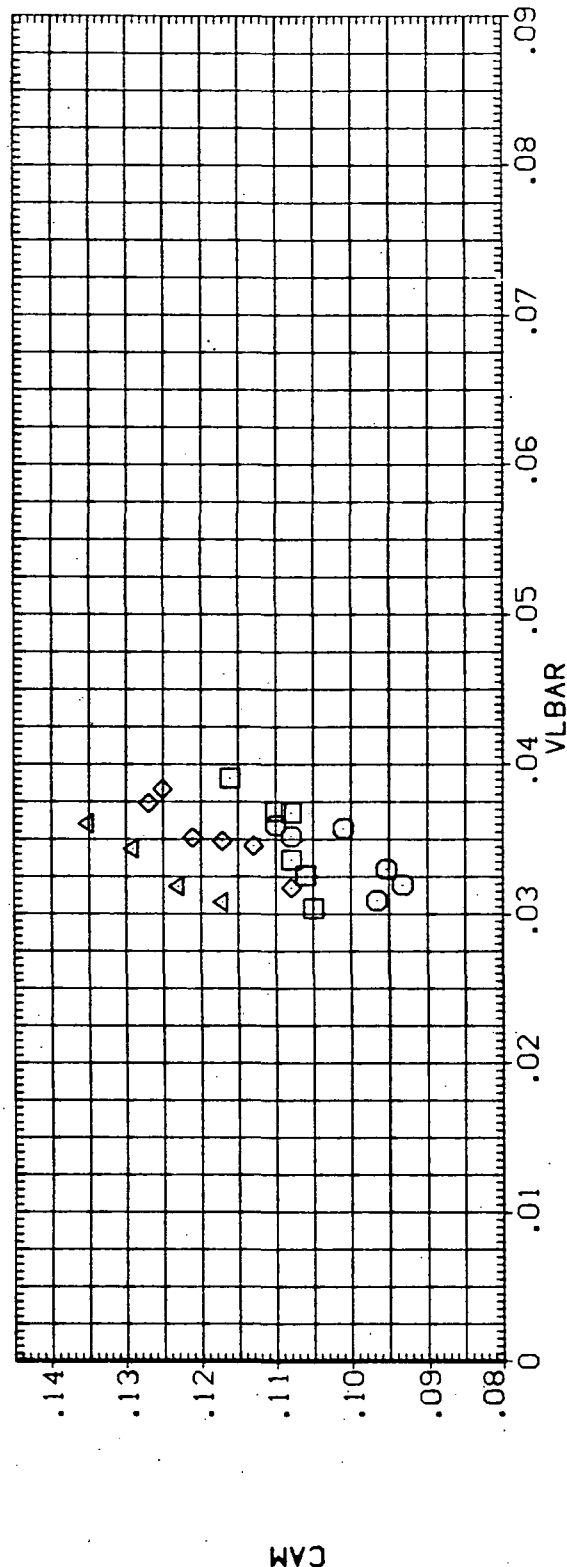


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL ALPHA BETA ELEVTR RUDDER BOFLAP
 20.000
 25.000
 30.000
 35.000

PARAMETRIC VALUES
 .000 RN/L
 .000 AILRON
 .000 SPDRK
 .000 MACH
 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP .0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

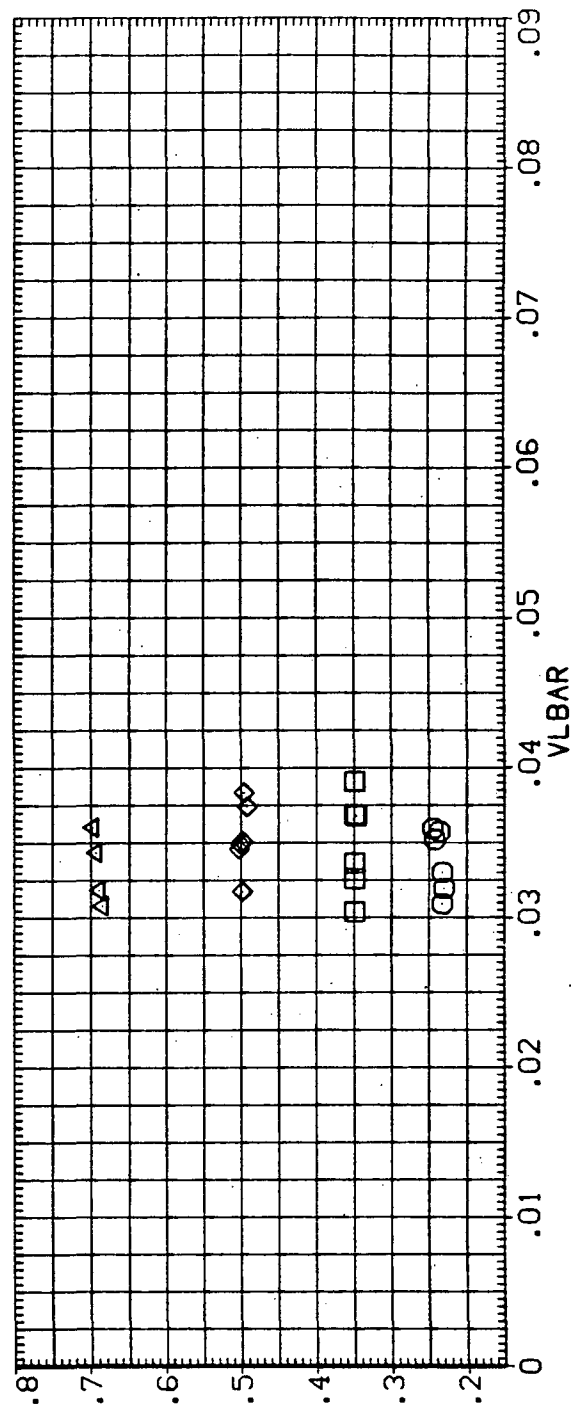
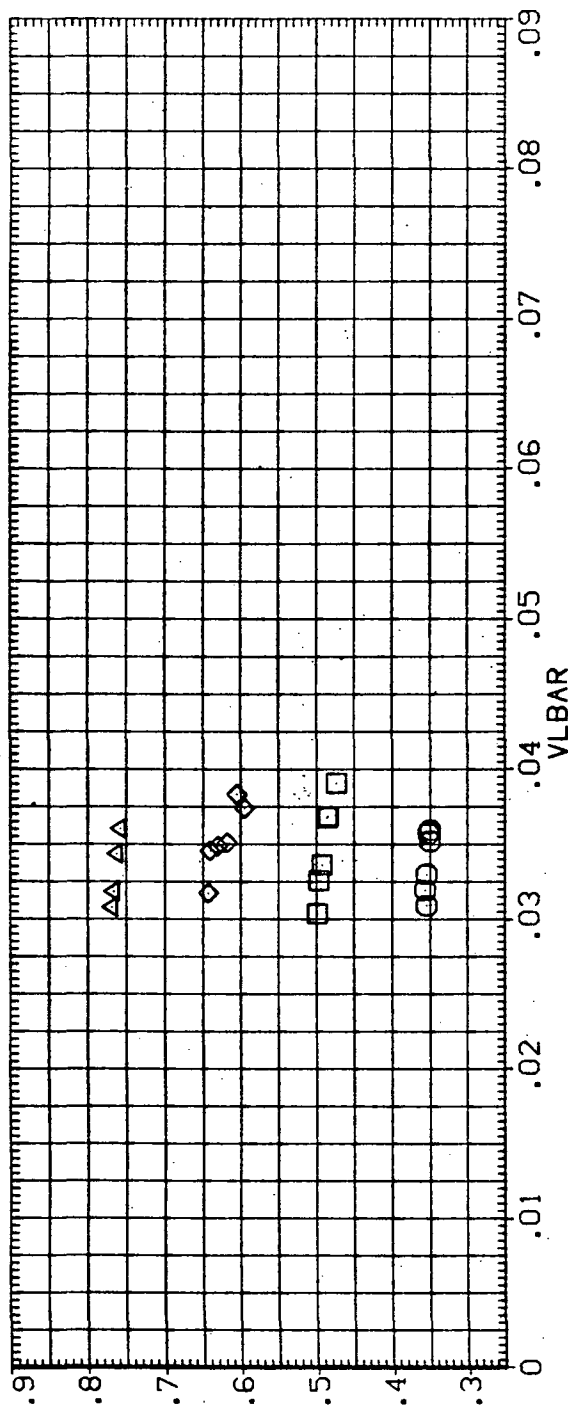


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0006)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	SCALE	SREF	SO.FT.	INCHES	INCHES
○	25.000	.000	.250		LREF	474.8000		
□	35.000	.000	.000		BREF	936.7000		
		.000	55.000		XHRP	1076.7000		
		.000	20.000		YHRP	375.0000		
		.000			ZHRP			
					SCALE	.0100		

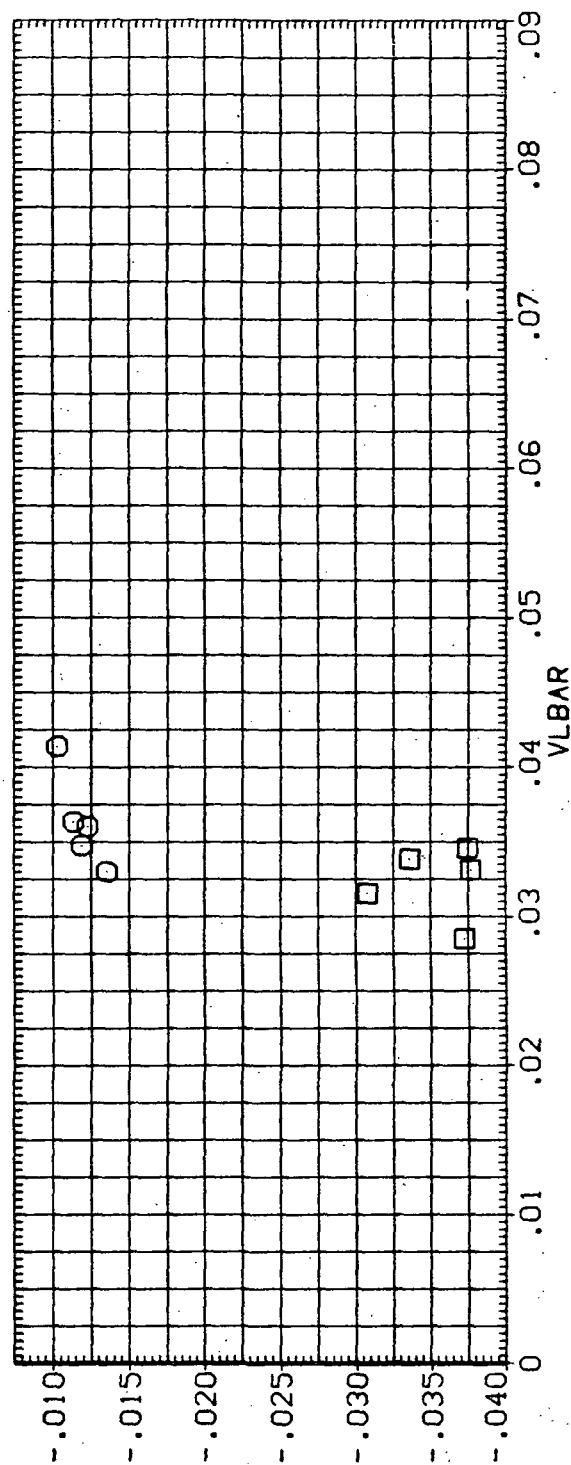
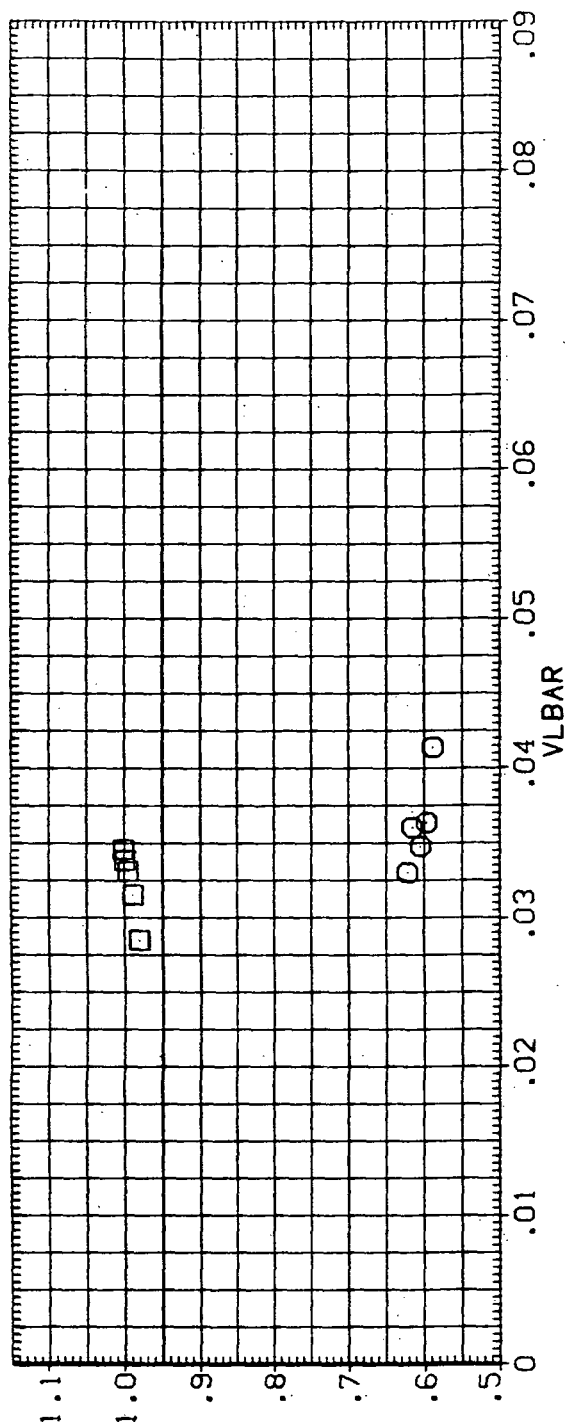


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	AILRON	SREF	SO.FT.	INCHES	
○	25.000	.000	.250	.000	LREF	474.8000	INCHES	
□	35.000	.000	.000	.000	BREF	936.7000	INCHES	
		.000	SPDRK	55.000	YMRP	1076.7000	INCHES	
		.000	MACH	20.000	ZMRP	375.0000	INCHES	
					SCALE	.0100		

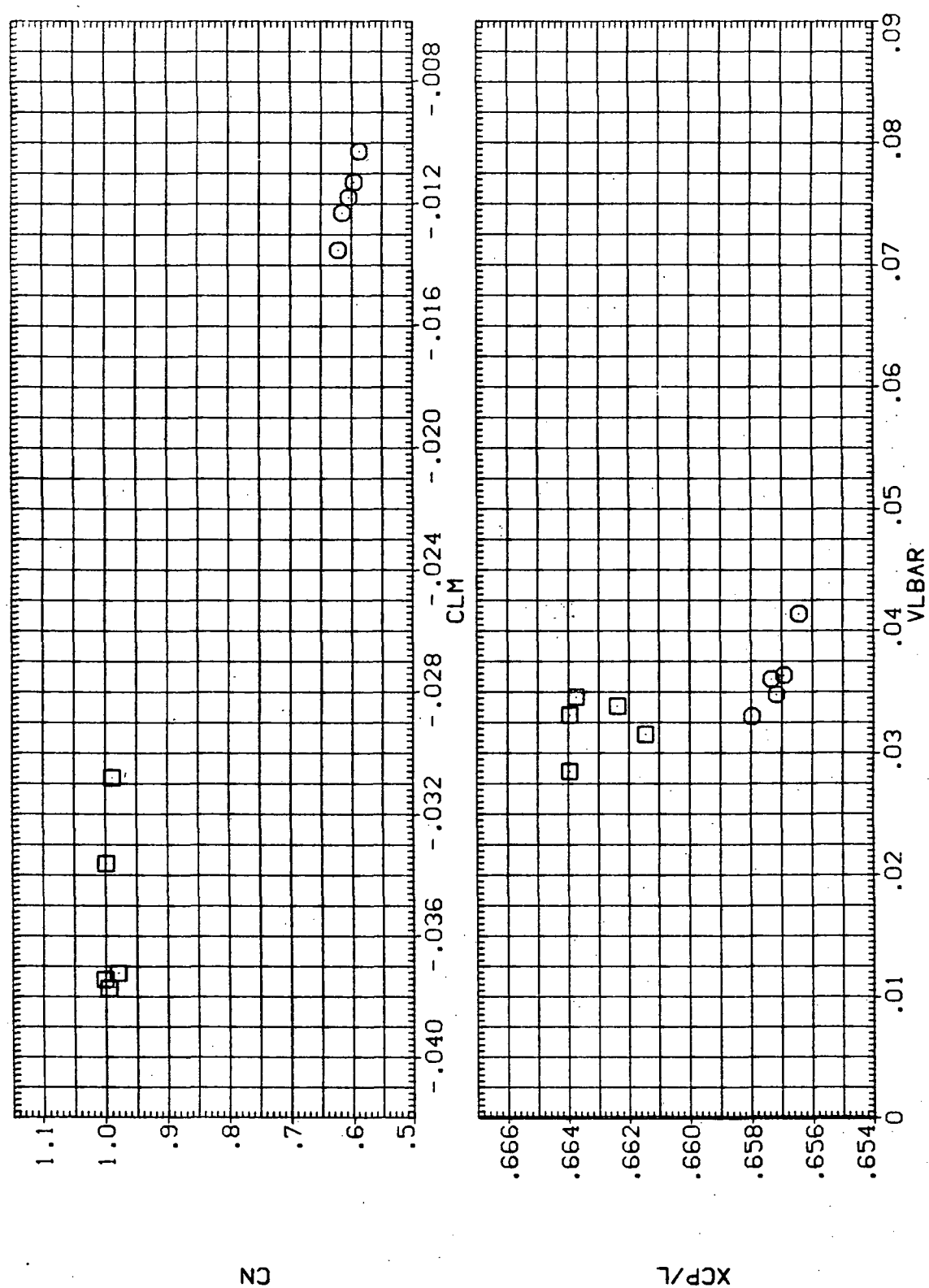


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0006)

SYMBOL
 ○
 □

ALPHA
 25.000
 35.000

BETA
 .000
 .000
 .000
 .000

ELEVTR
 .000
 .000
 .000
 .000

RUDDER
 .000
 .000
 .000
 .000

BDFLAP
 .000
 .000
 .000
 .000

PARAMETRIC VALUES
 RN/L .250
 AILRON .000
 SPD BRK 55.000
 MACH 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP 375.0000 INCHES
 ZMRP .0100 INCHES
 SCALE

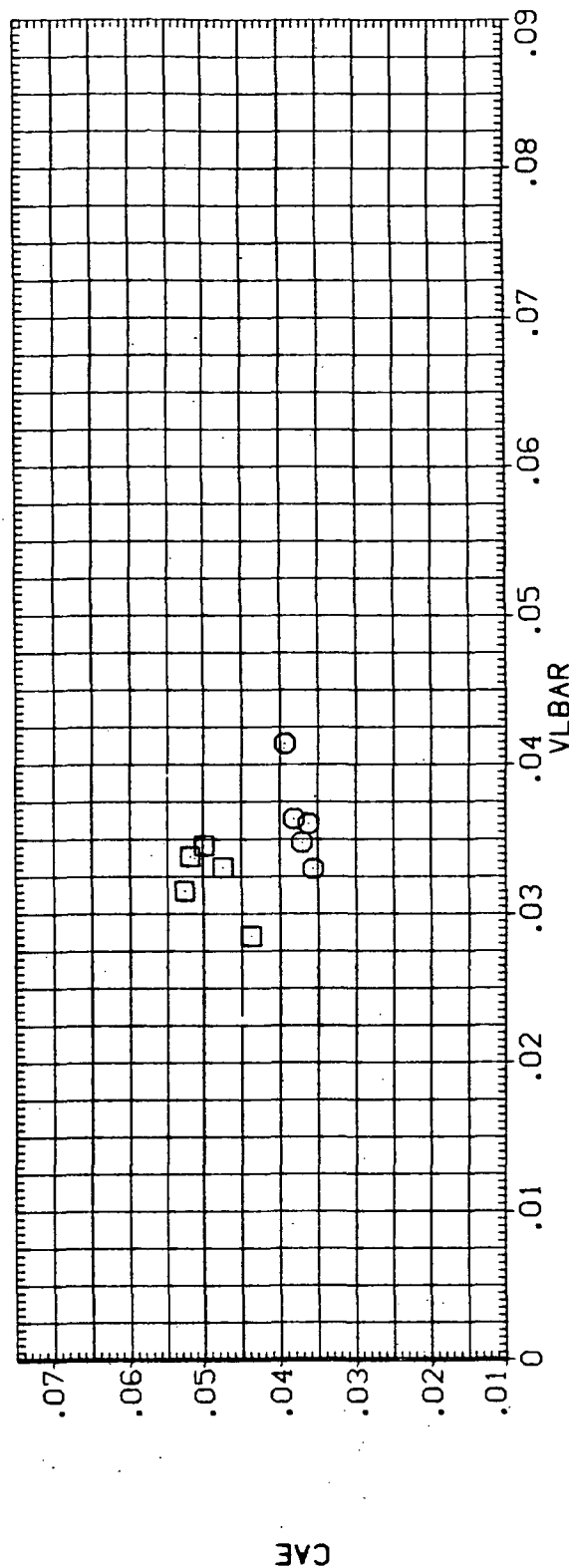
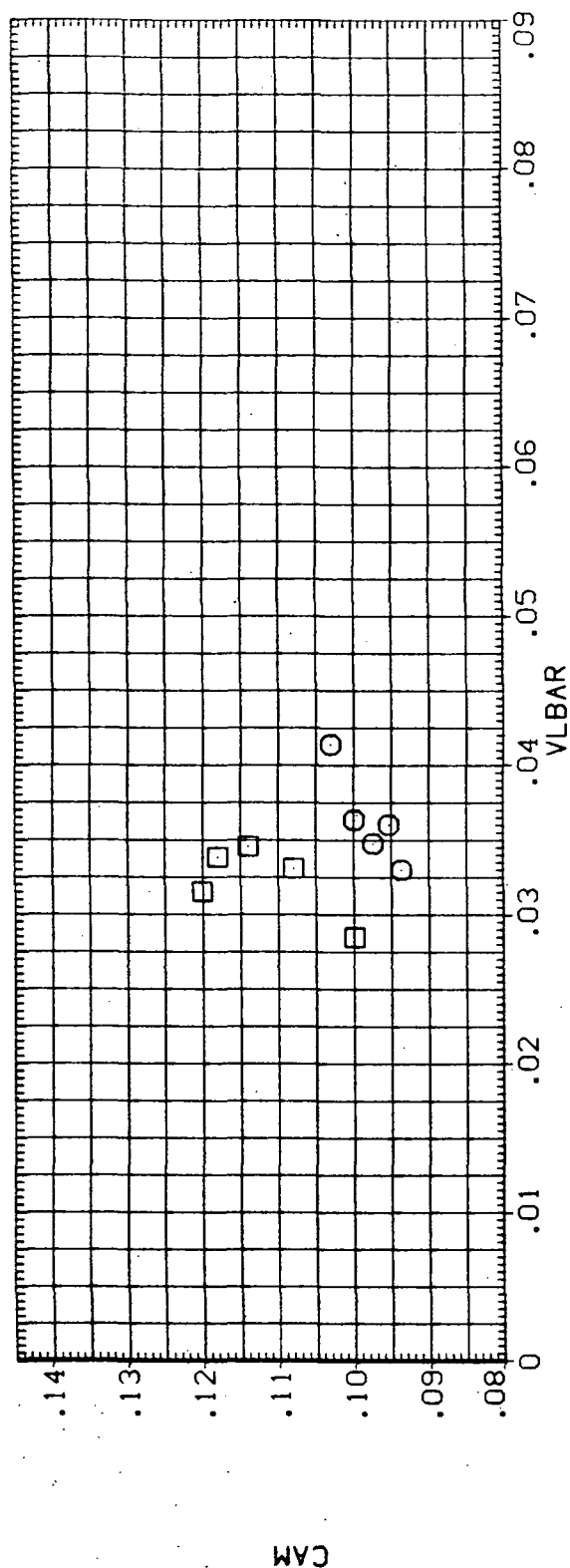


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	AILRON	SREF	2690.0000	SQ.FT.	
○	25.000	.000	.250	.000	LREF	474.8000	INCHES	
□	35.000	.000	.000	.000	BREF	936.7000	INCHES	
		.000	SPDRK	55.000	XMRP	1076.7000	INCHES	
		.000	MACH	20.000	YMRP	.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

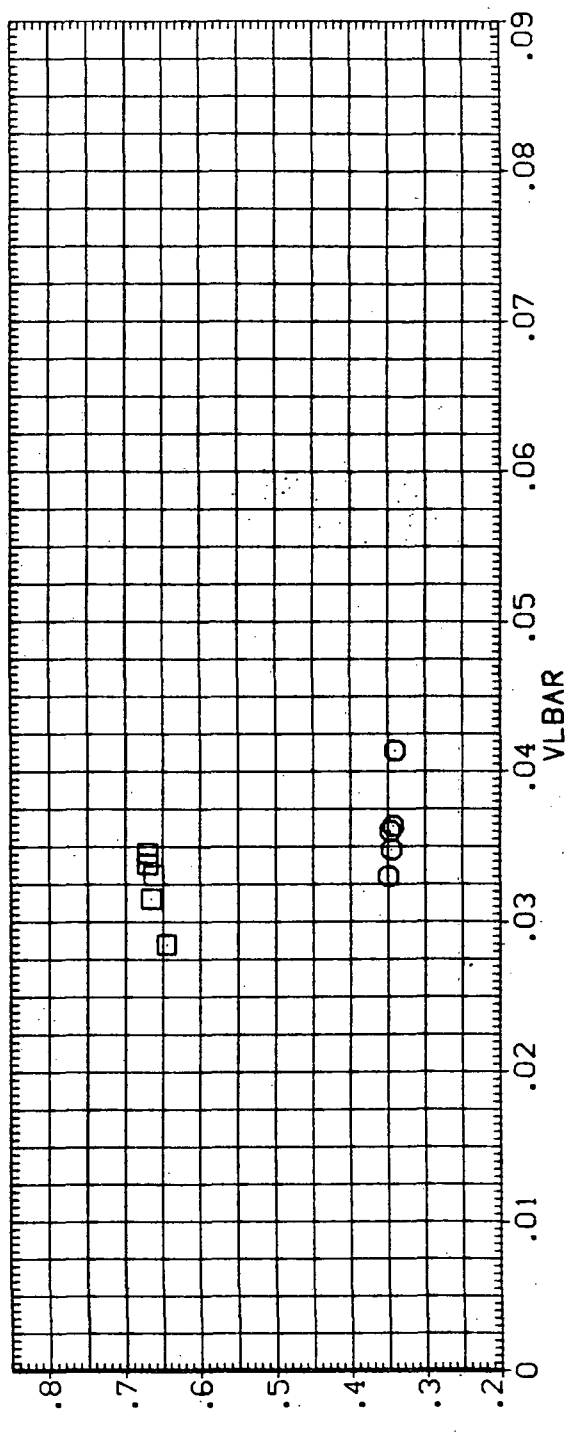
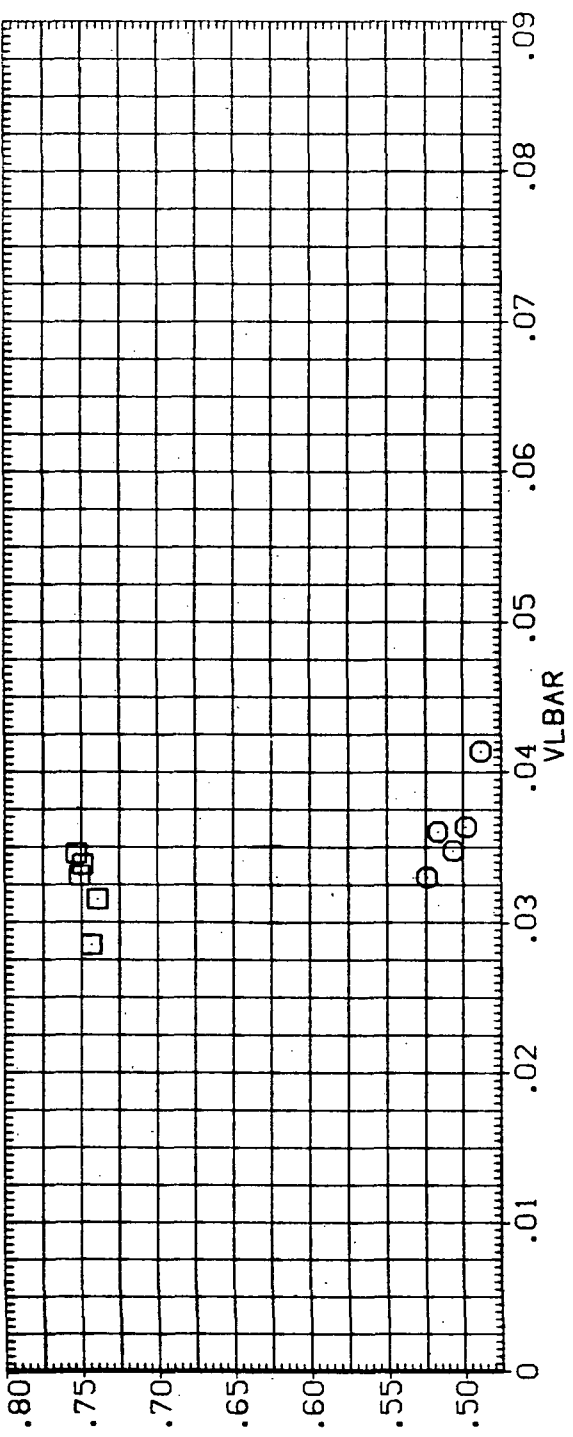


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0007)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION	
	ALPHA	BETA	RN/L	AILRON	SREF	SO, FT.
○	20.000	.000	.500	.000	LREF	474.8000
□	25.000	.000	.000	.000	BREF	936.7000
◇	30.000	.000	SPDRK	55.000	YMRP	1076.7000
△	35.000	.000	MACH	16.000	ZMRP	375.0000
					SCALE	.0100

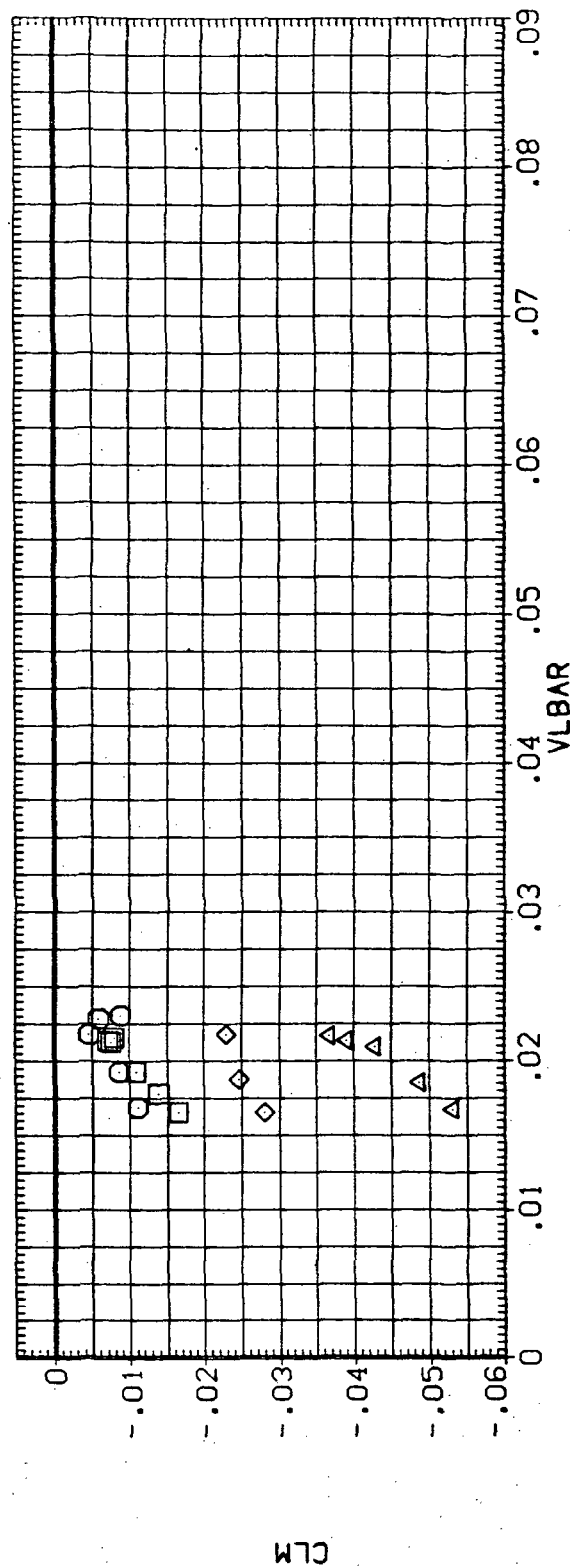
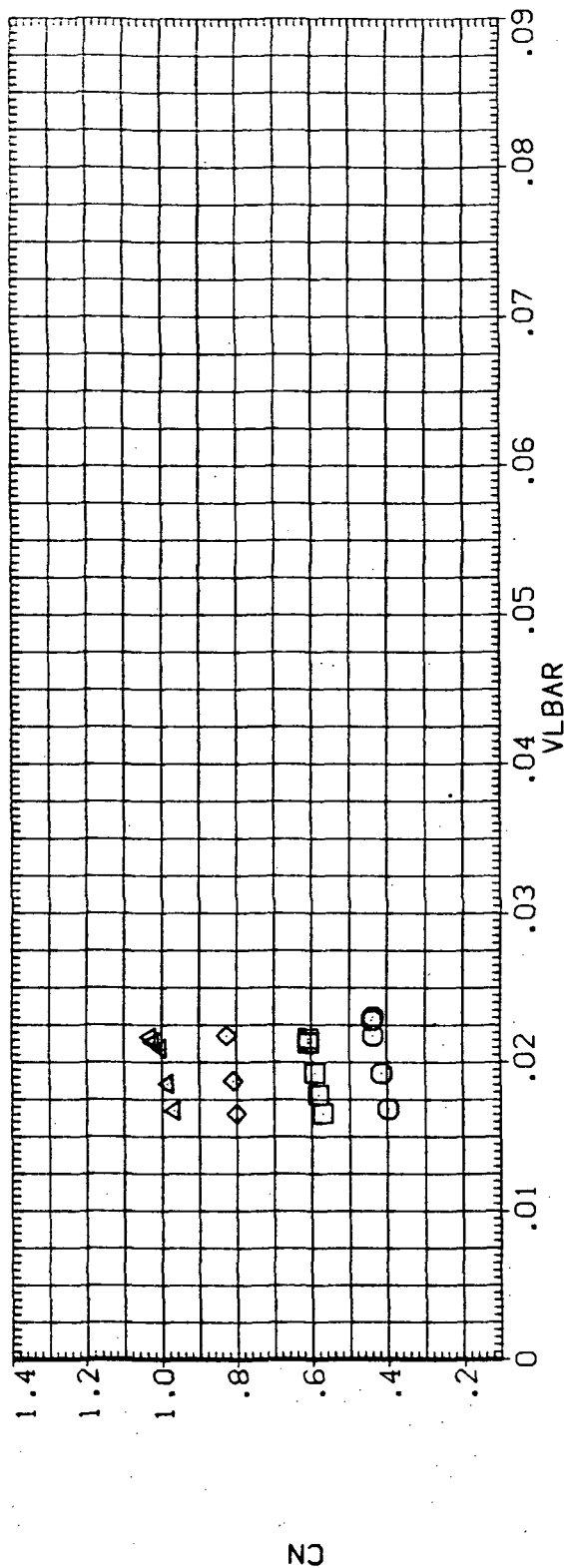


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	SCALE	SREF	LREF	BREF	XMRP
○	20.000	.000	.500		2690.0000	50.47	474.8000	936.7000
□	25.000	.000	.000				1076.7000	
◇	30.000	.000	55.000					
△	35.000	.000	16.000					

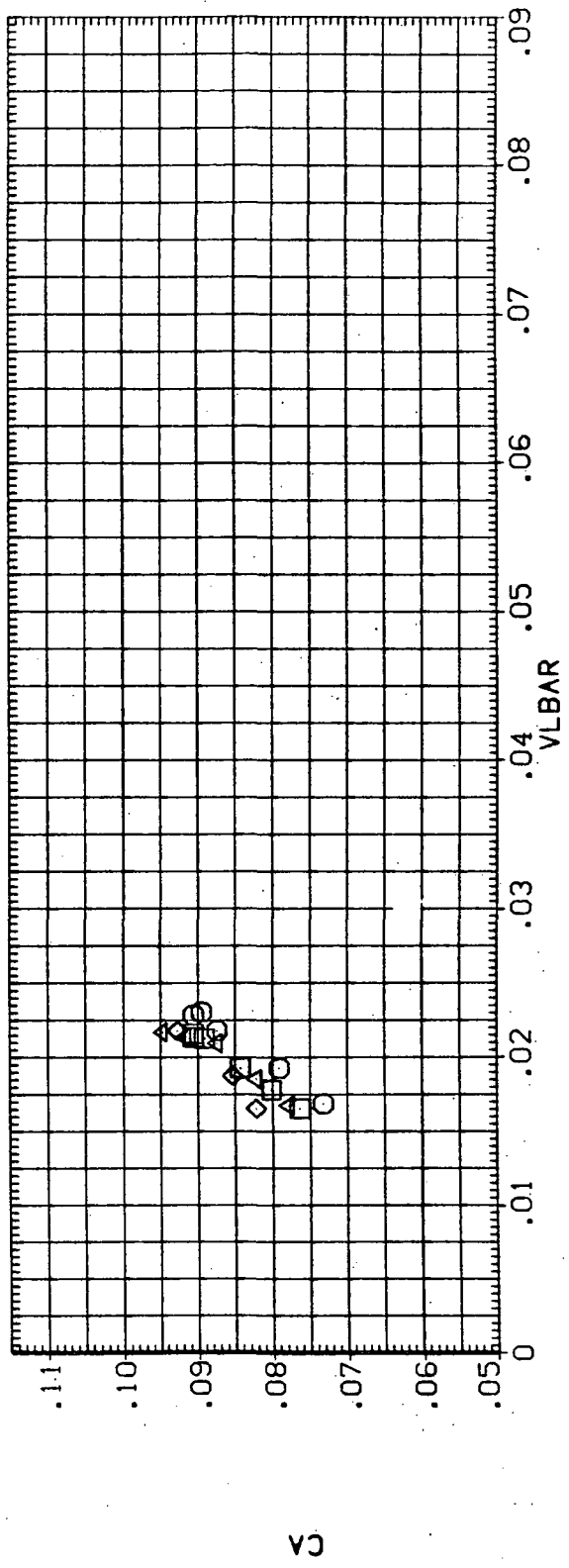
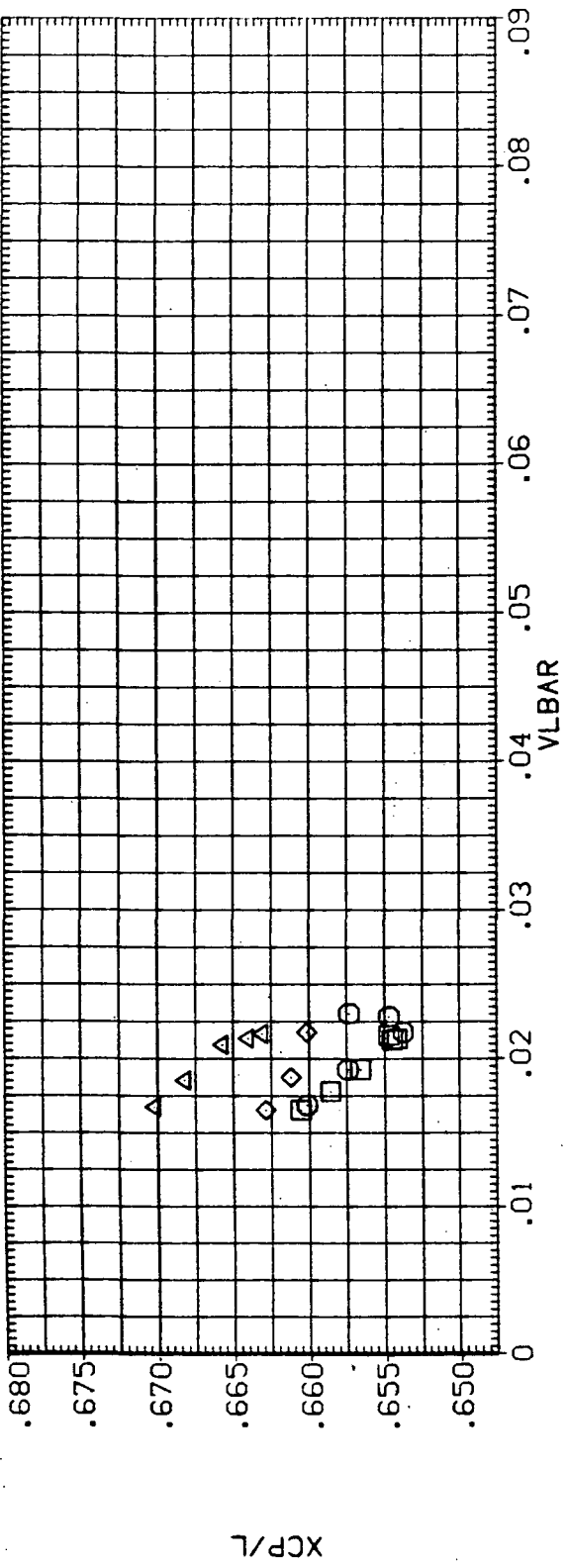


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0007)

SYMBOL
 ○ □ ◇ △

ALPHA
 20.000
 25.000
 30.000
 35.000

BETA
 .000
 .000
 .000
 .000

ELEVTR
 .000
 .000
 .000
 .000

RUDDER
 .000
 .000
 .000
 .000

BDFLAP
 .000
 .000
 .000
 .000

PARAMETRIC VALUES
 RN/L .500
 AILRON .000
 SPDBRK 55.000
 MACH 16.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 YMRP 1076.7000 INCHES
 ZMRP .0000 INCHES
 SCALE 375.0000 INCHES
 .0100

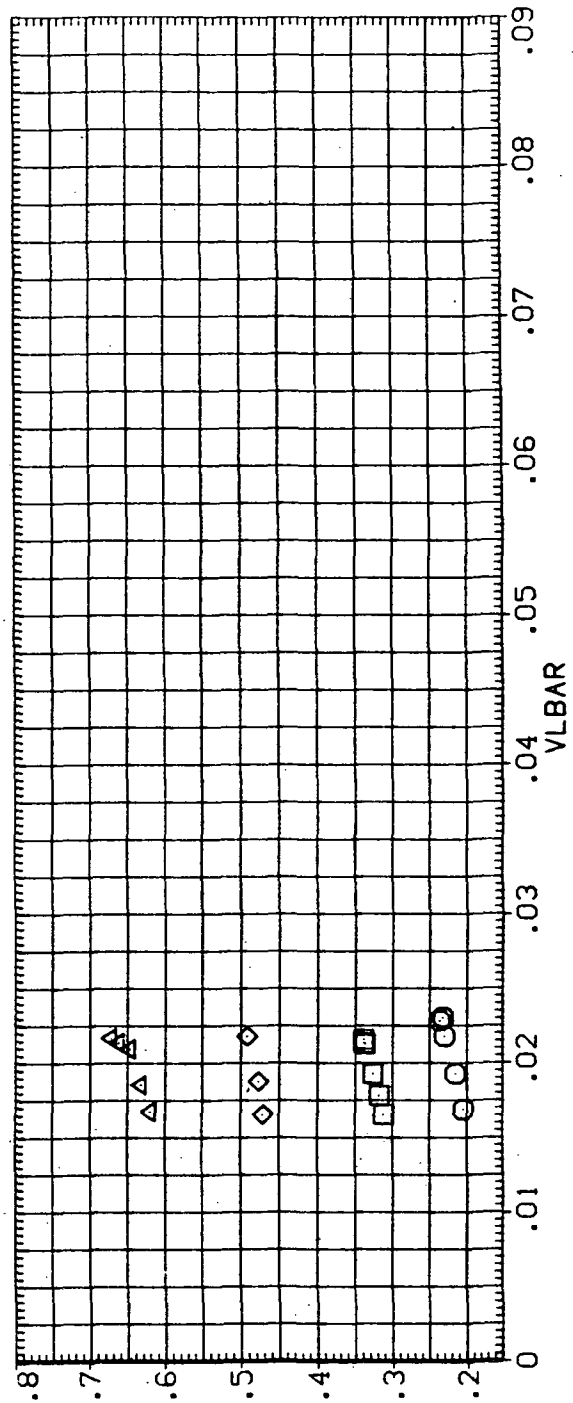
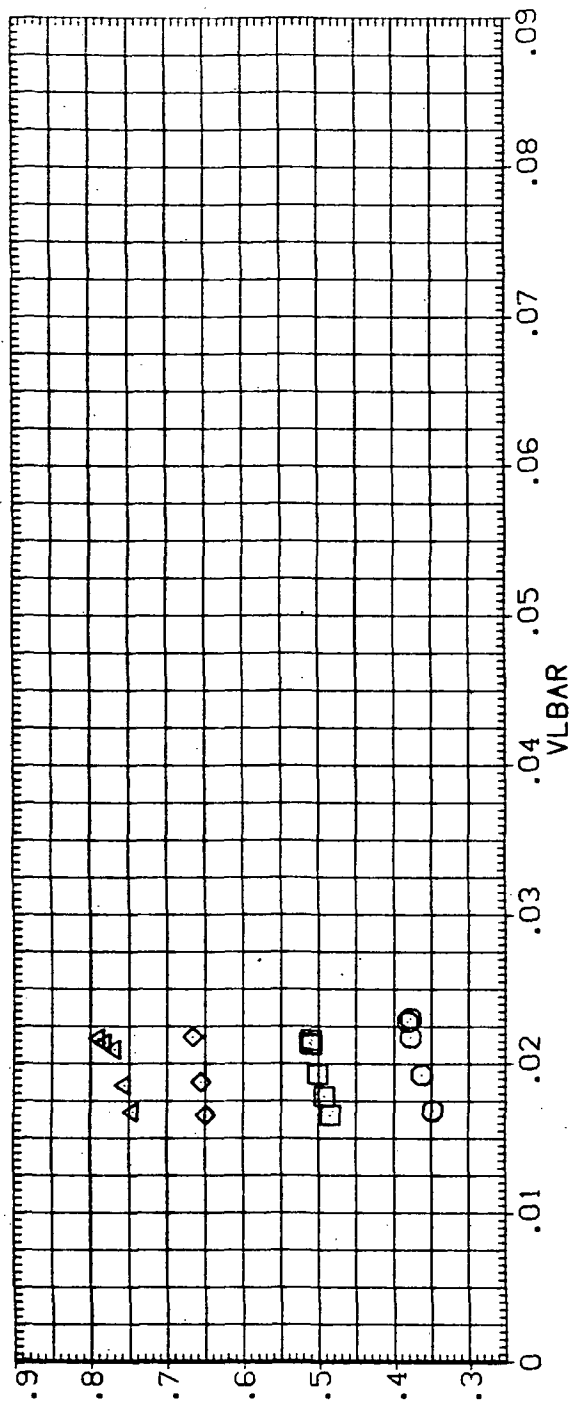


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL ALPHA BETA ELEVTR RUDDER BOFLAP
 O 20.000 .000 .000 .000 .000
 □ 25.000 .000 .000 .000 .000
 ◇ 30.000 .000 .000 .000 .000
 △ 35.000 .000 .000 .000 .000

PARAMETRIC VALUES
 RN/L .070
 AILRON .000
 SPOBRK 55.000
 MACH 20.000

REFERENCE INFORMATION
 SREF 2690.0000
 LREF 474.8000
 BREF 936.7000
 XMRP 1076.7000
 YMRP .0000
 ZMRP .0000
 SCALE .0100

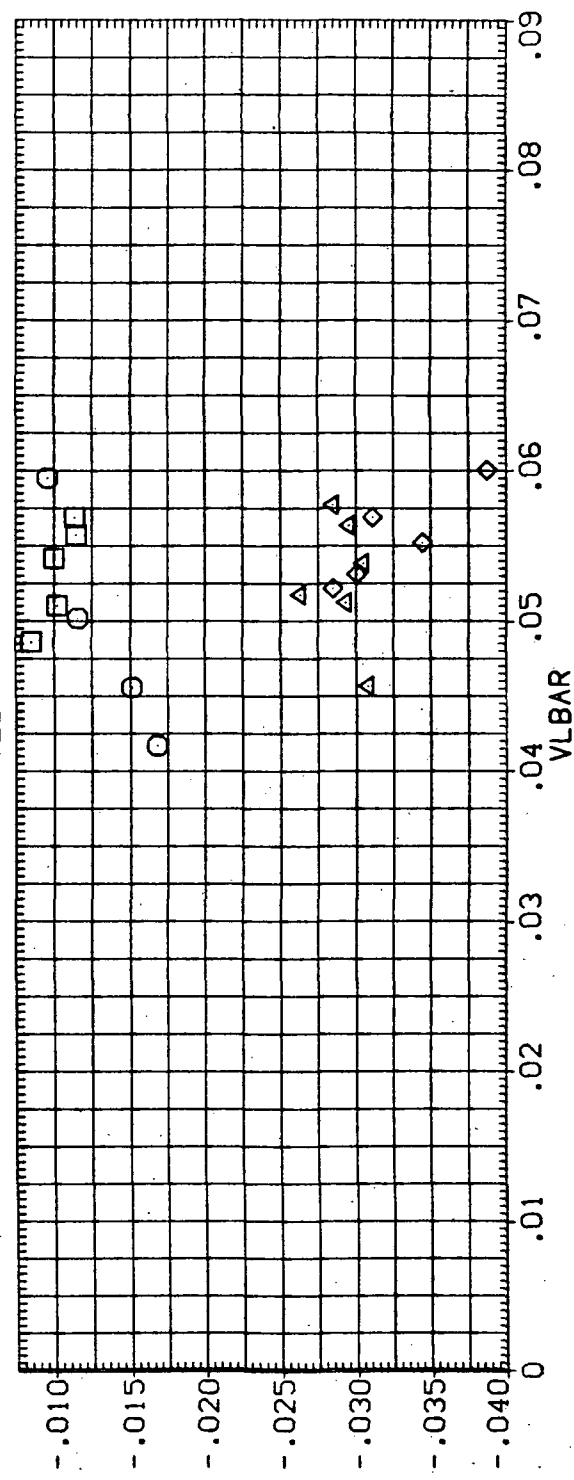
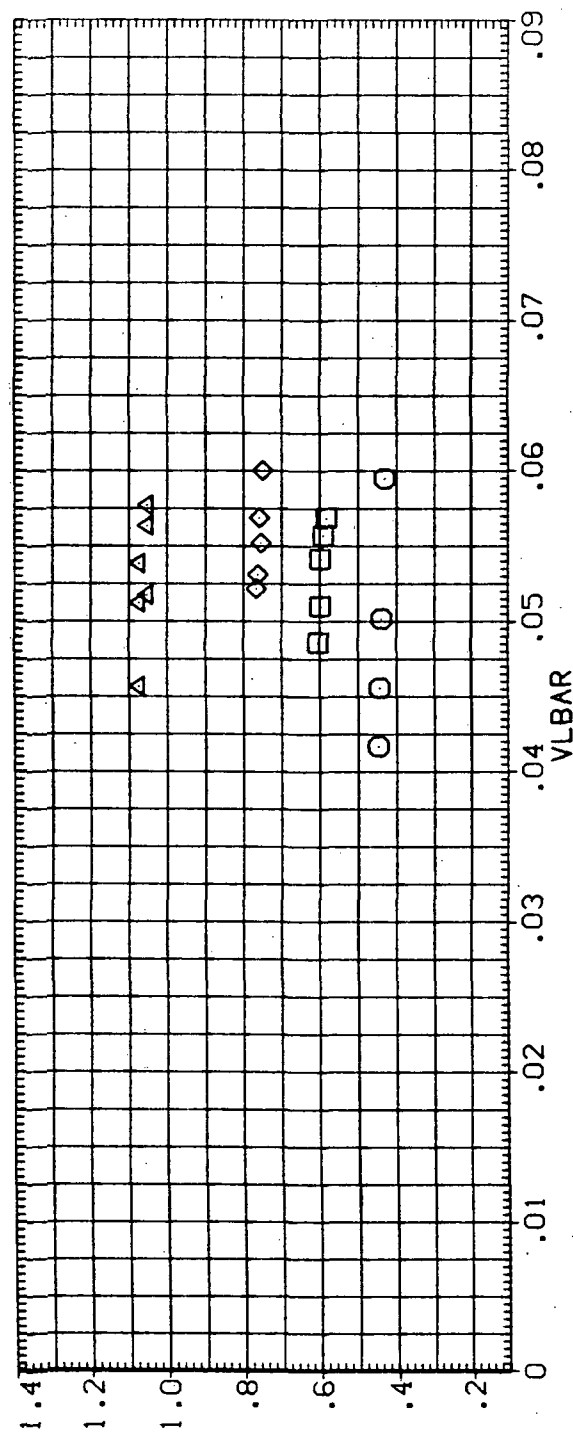


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0008)

SYMBOL	ALPHA	BETA	PARAMETRIC VALUES
○	20.000		.000 RN/L
□	25.000	ELEVTR	.000 AILRON
◇	30.000	RUDDER	.000 SPDBRK
△	35.000	BDFLAP	.000 MACH
			55.000
			20.000

REFERENCE INFORMATION	
SREF	2690.0000
LREF	474.8000
BREF	936.7000
XMRP	1076.7000
YMRP	375.0000
ZMRP	1076.7000
SCALE	.0100

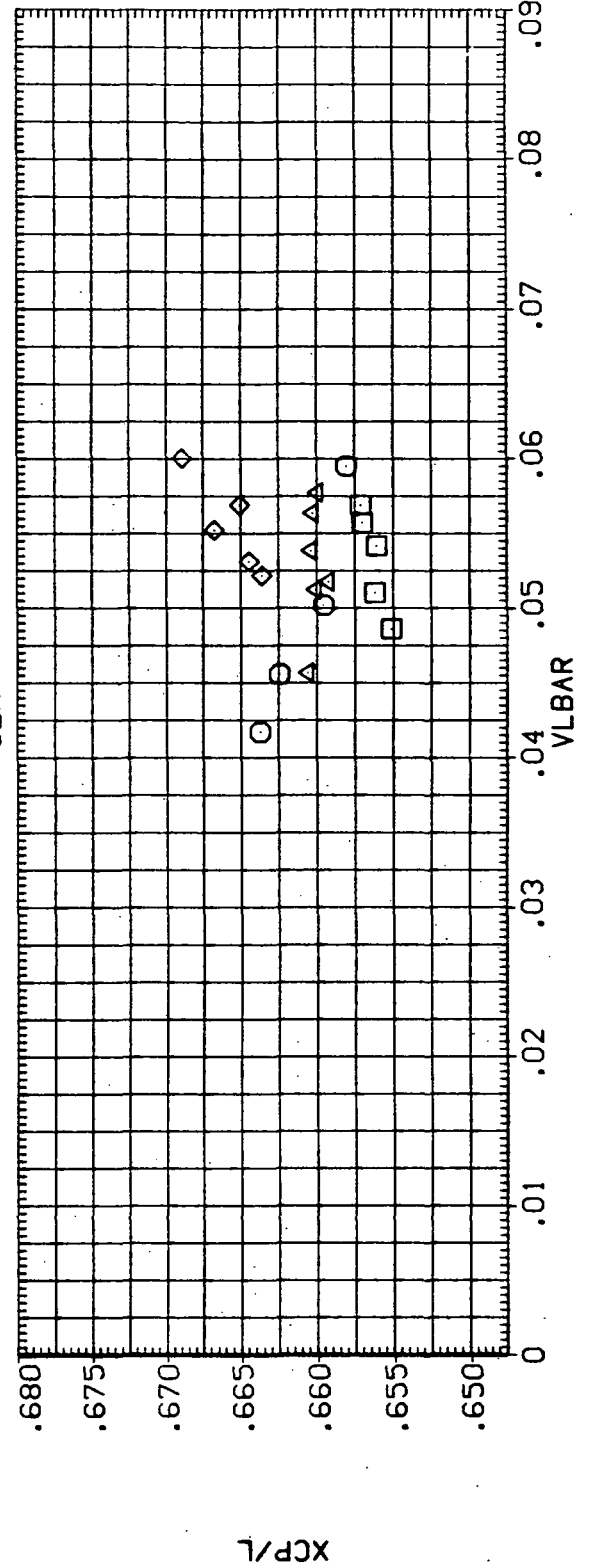
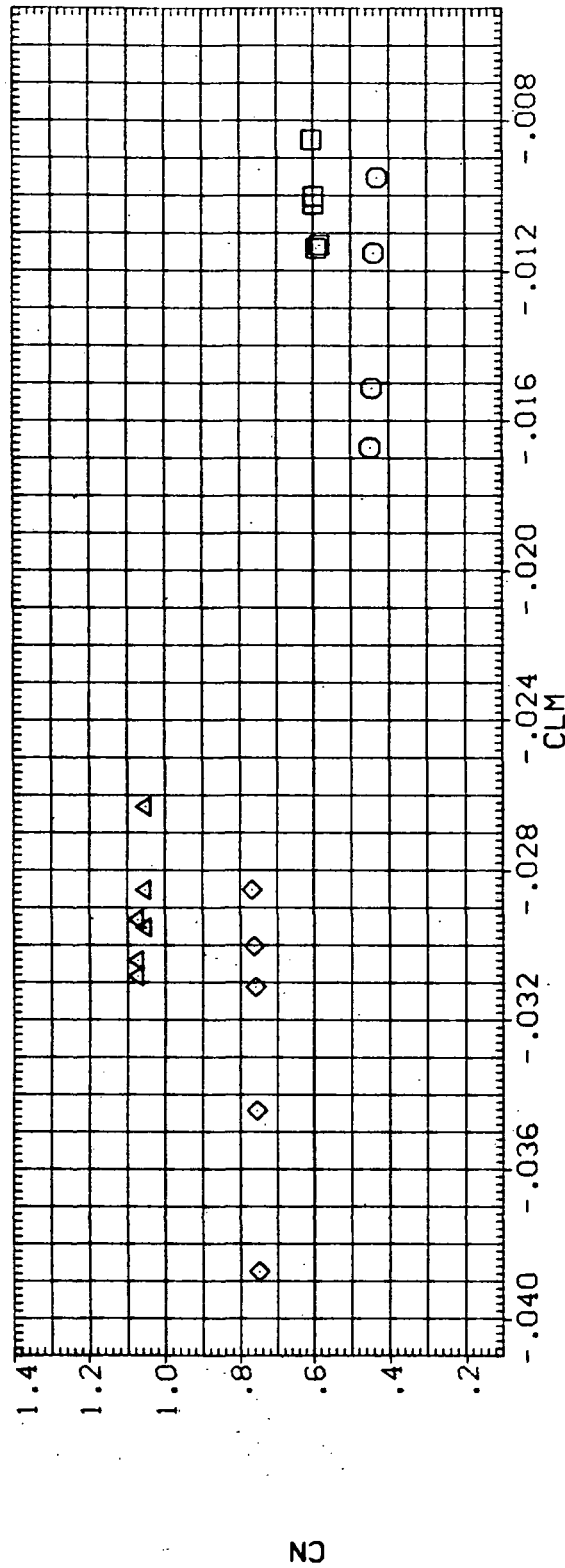


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	INCHES	SREF	LREF	BREF	INCHES
○	20.000	.000	.070	.000	2690.0000	474.8000	936.7000	.0000
□	25.000	.000	.000	.000	1076.7000	375.0000	375.0000	.0100
◇	30.000	.000	.000	.000				
△	35.000	.000	.000	.000				

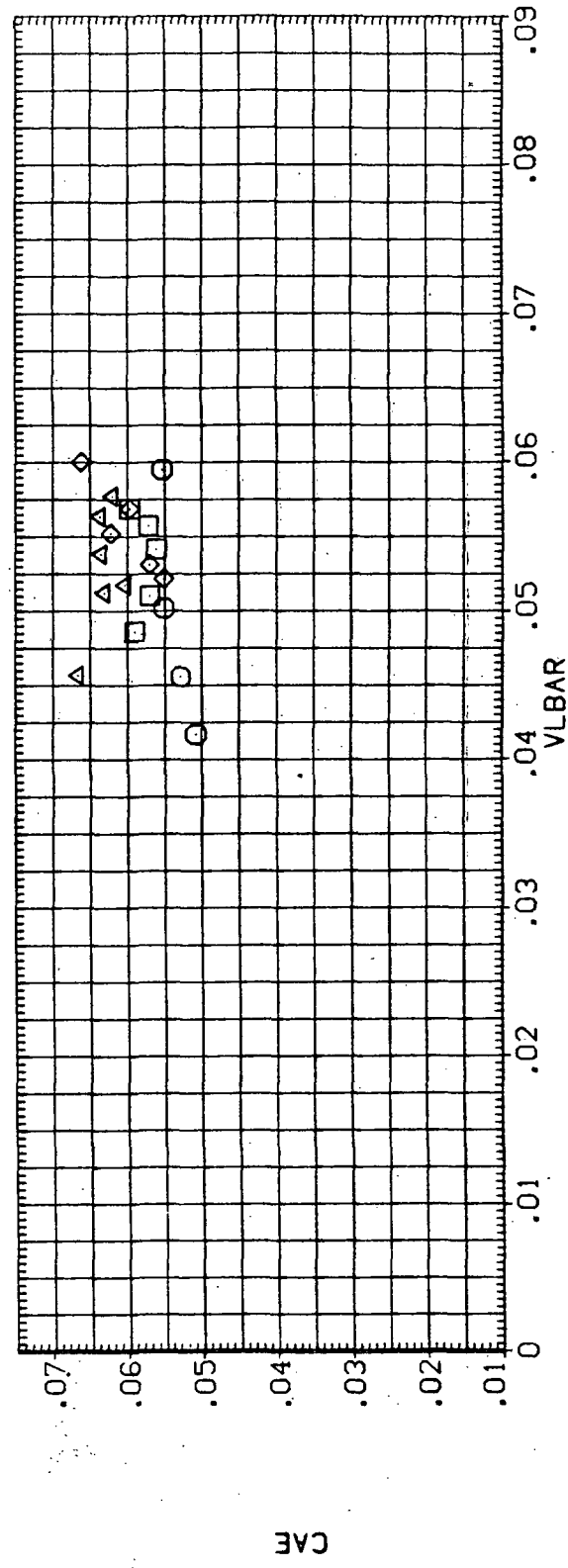
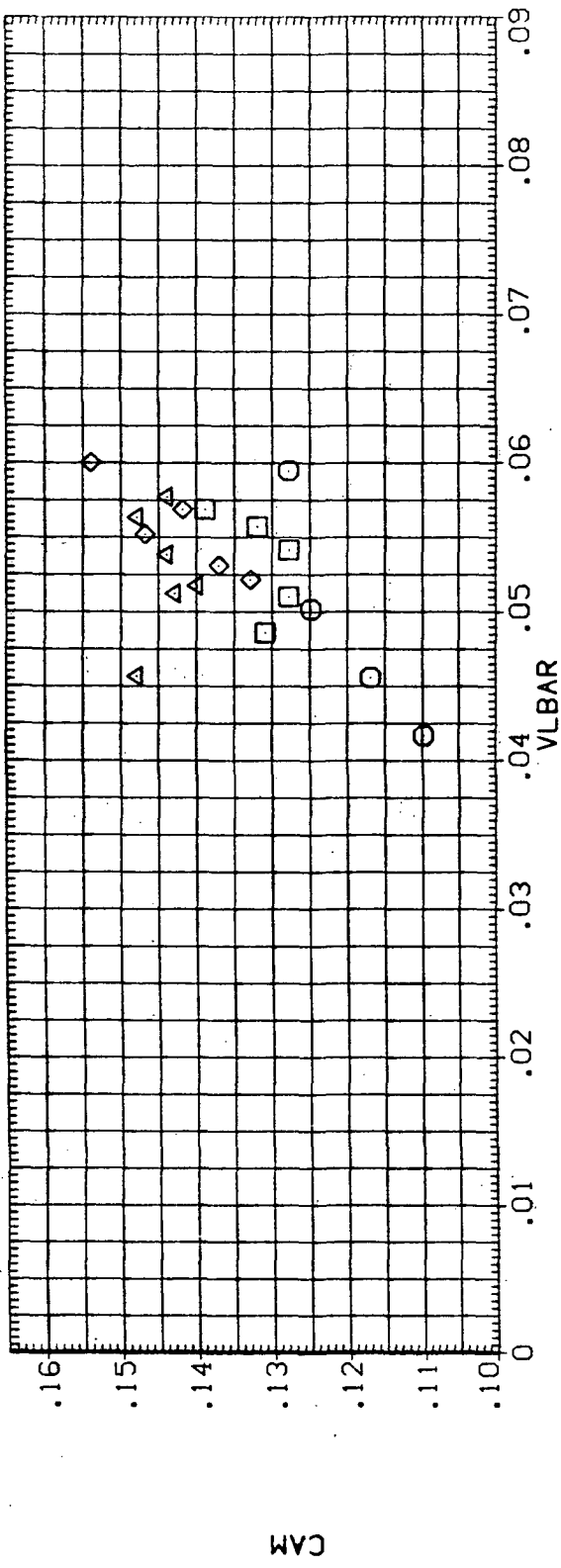


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0008)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L		SREF	2690.0000	SO.FT.	
□	20.000	ELEVTR	.000	AILRON	LREF	474.8000	INCHES	
◇	25.000	RUDDER	.000	SPDBRK	BREF	936.7000	INCHES	
△	30.000	BOFLAP	.000	MACH	XMRP	1076.7000	INCHES	
	35.000				YMRP	.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

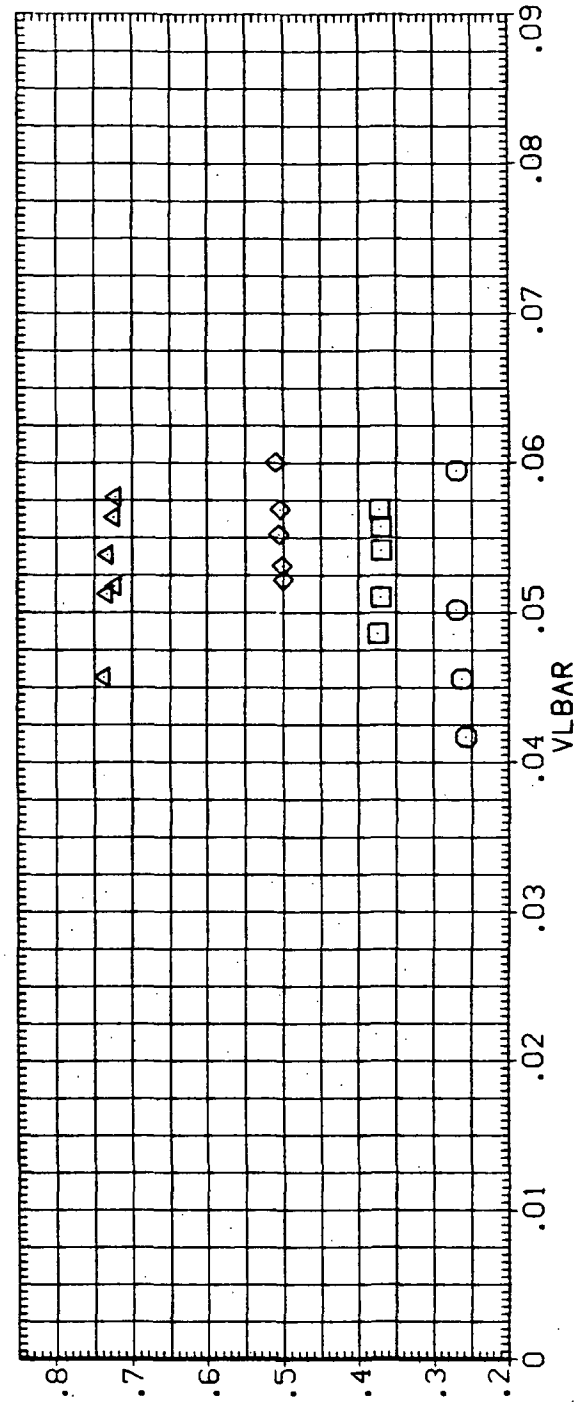
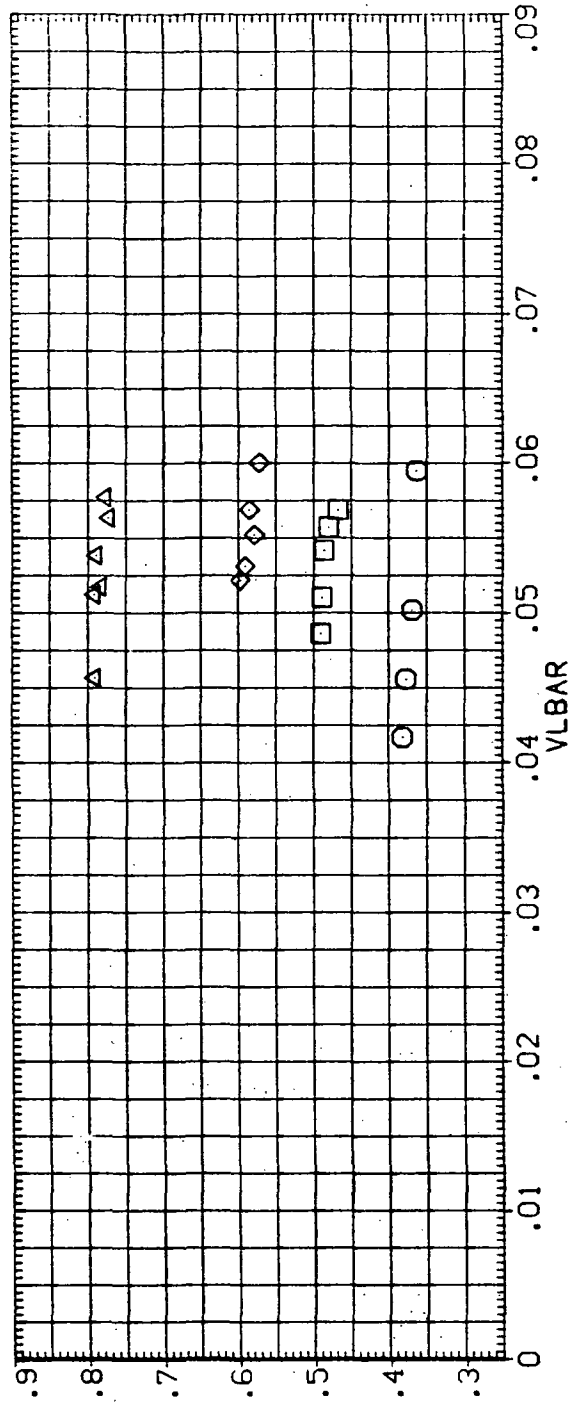


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL ALPHA 35.000
O

PARAMETRIC VALUES
BETA .000 RN/L .500
ELEVTR .000 ALLRON .000
RUDDER .000 SPDBRK 55.000
BDFLAP .000 MACH 16.000

REFERENCE INFORMATION
SREF 2690.0000 SO.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XMRP 1076.7000 INCHES
YMRP .0000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

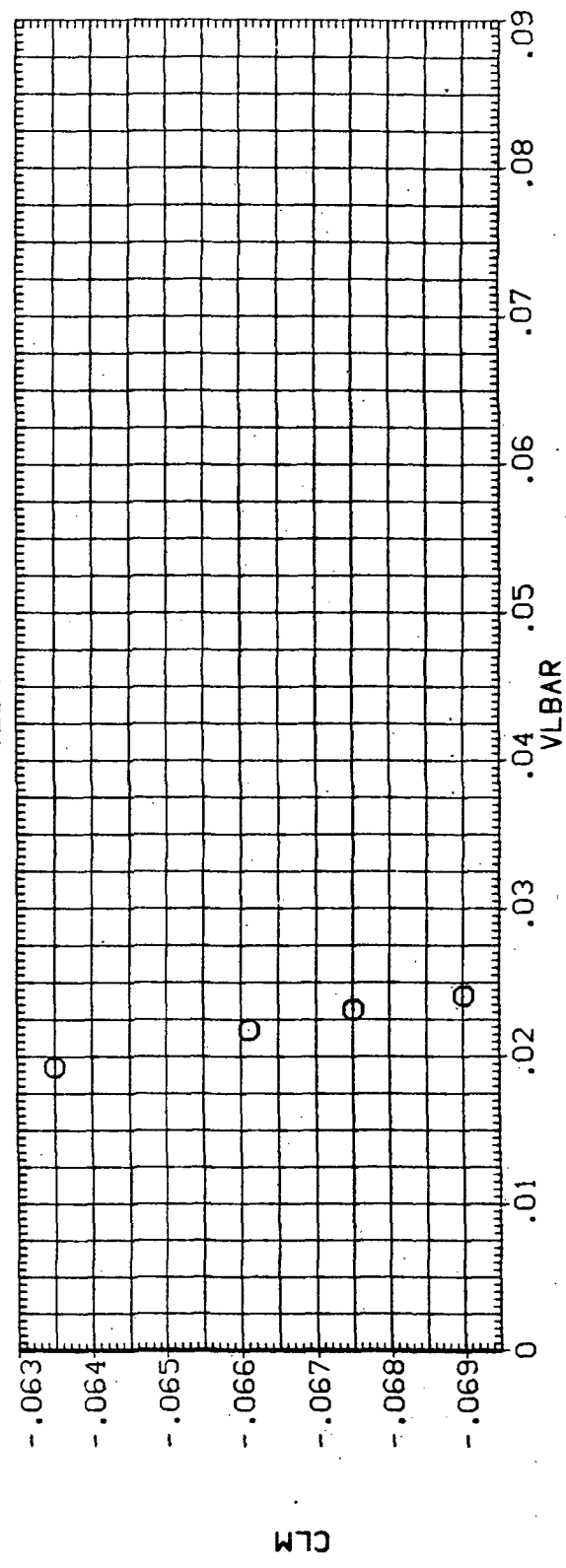
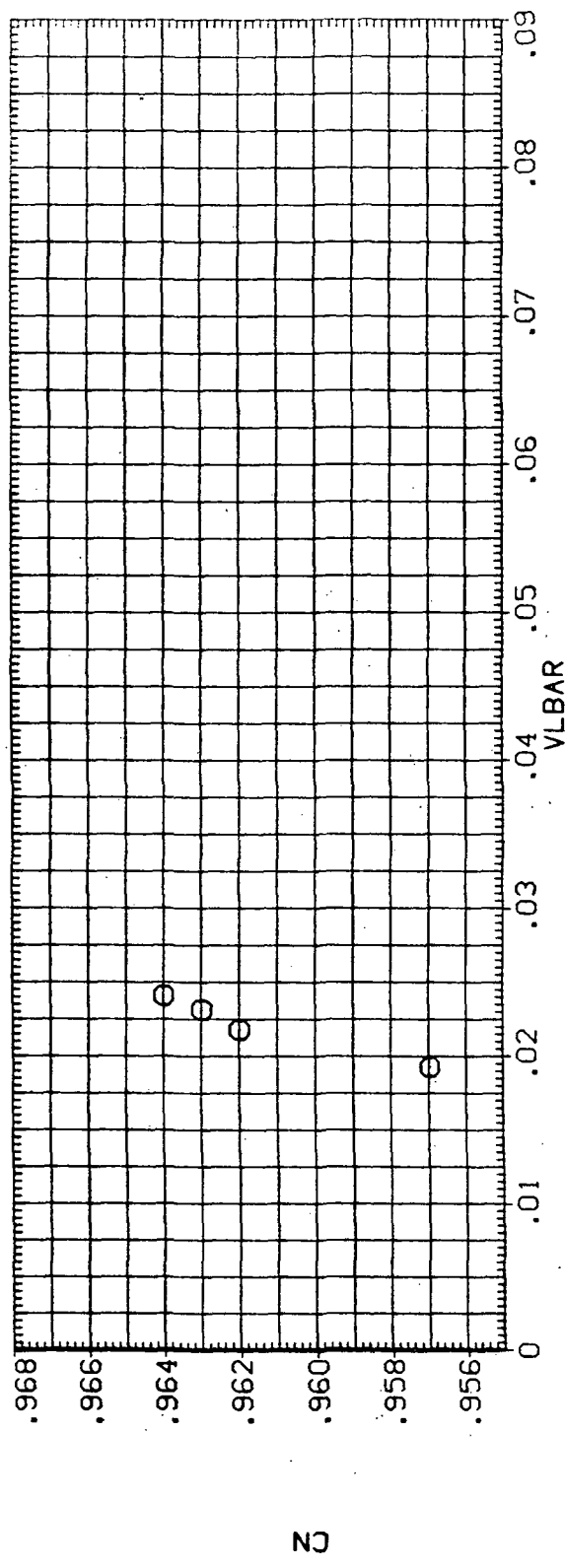


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0009)

SYMBOL
O

ALPHA
35.000

BETA
ELEVTR
RUDDER
BDFLAP

PARAMETRIC VALUES
.000 RN/L
.000 AILRON
.000 SPDBRK
.000 MACH

.500
.000
55.000
16.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
YMRP 1076.7000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

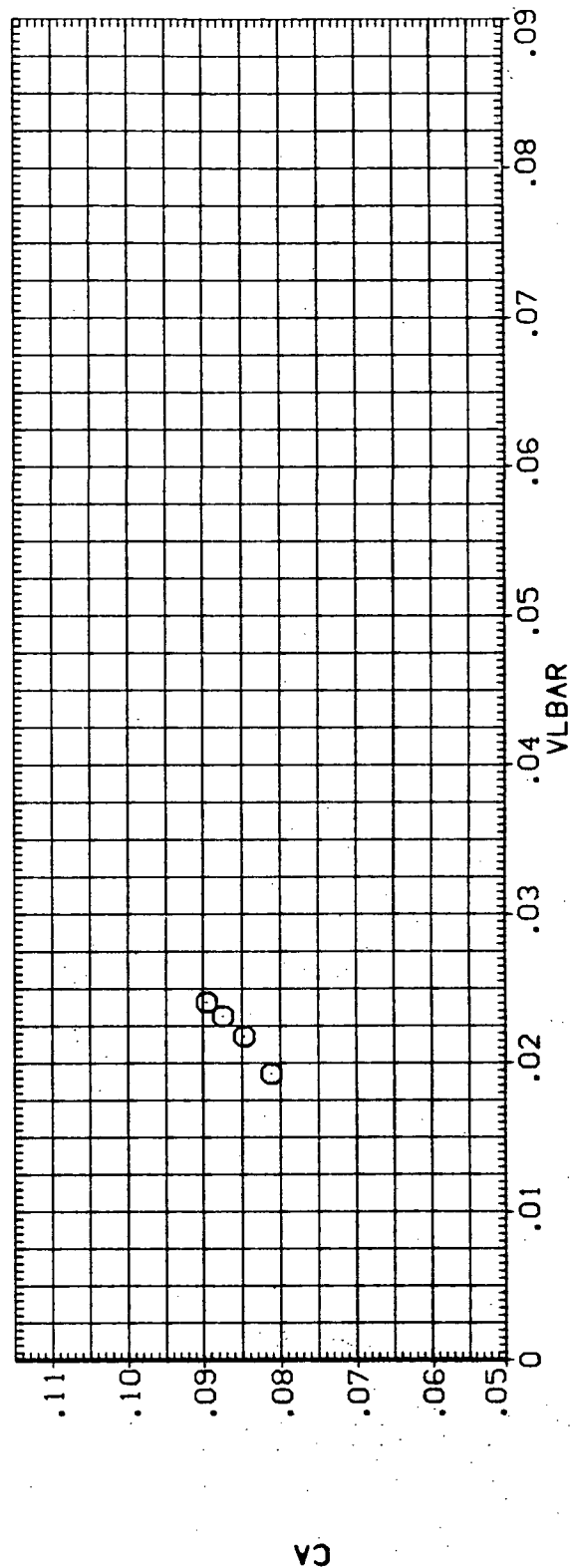
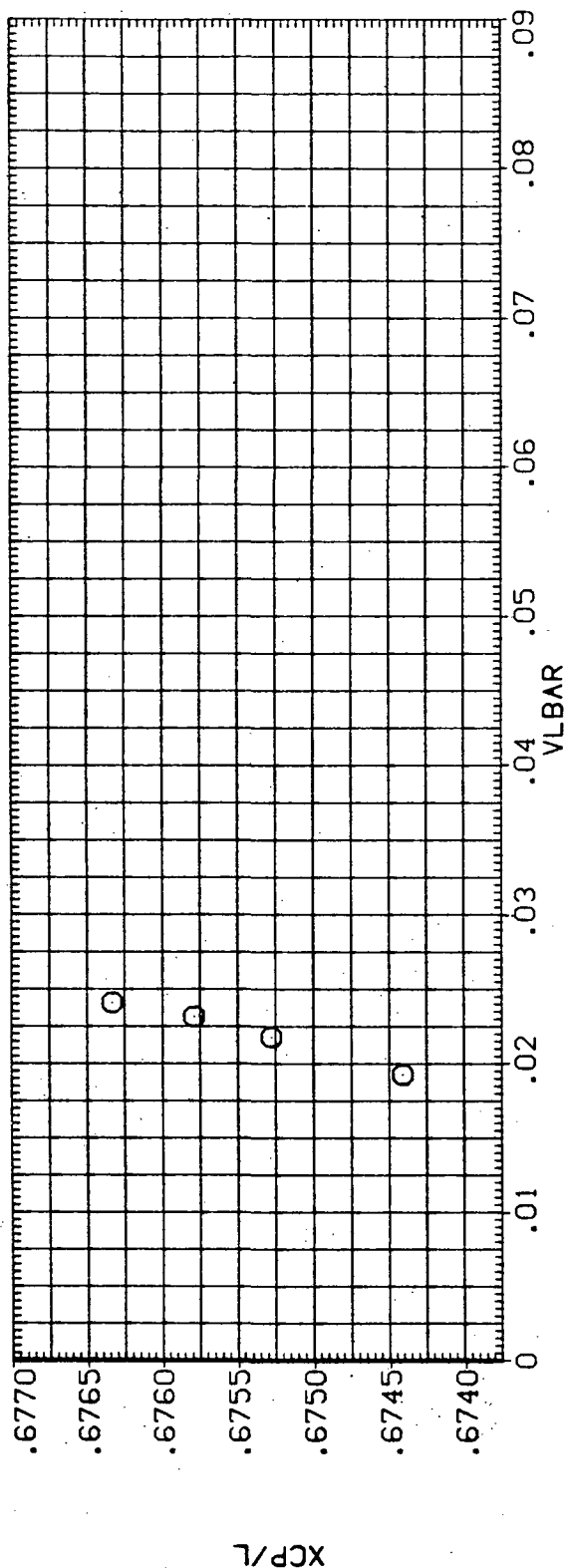


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
O

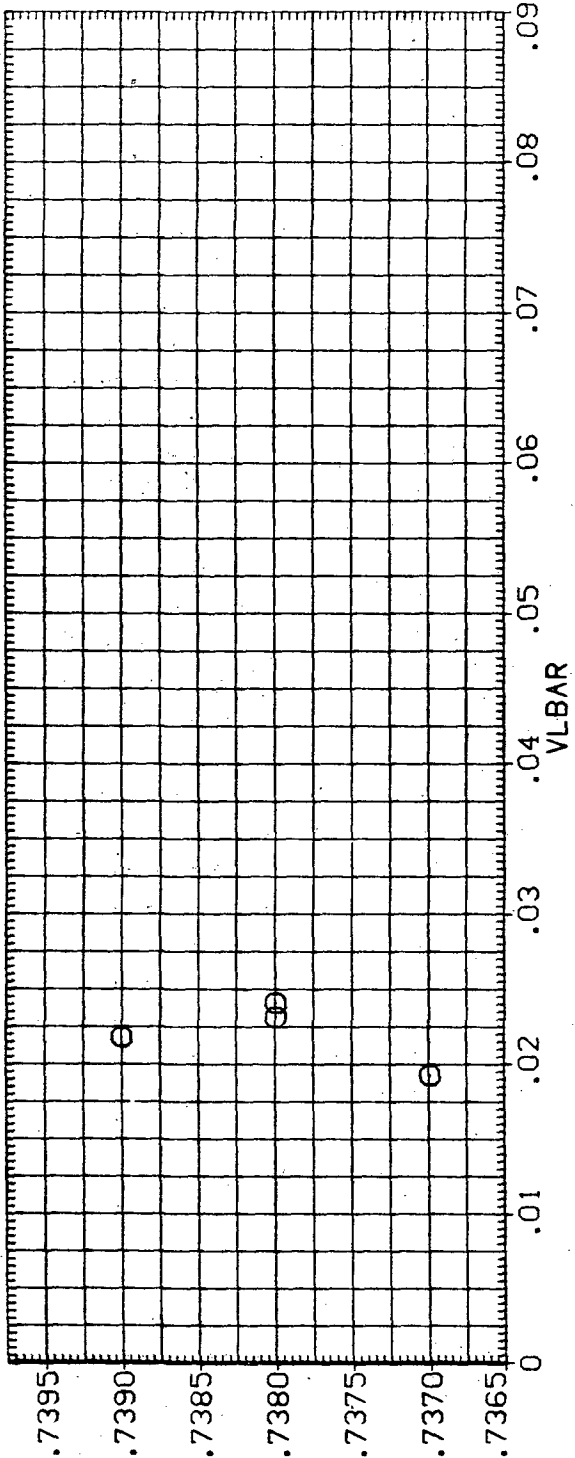
ALPHA
35.000

BETA
ELEVTR
RUDDER
BOFLAP

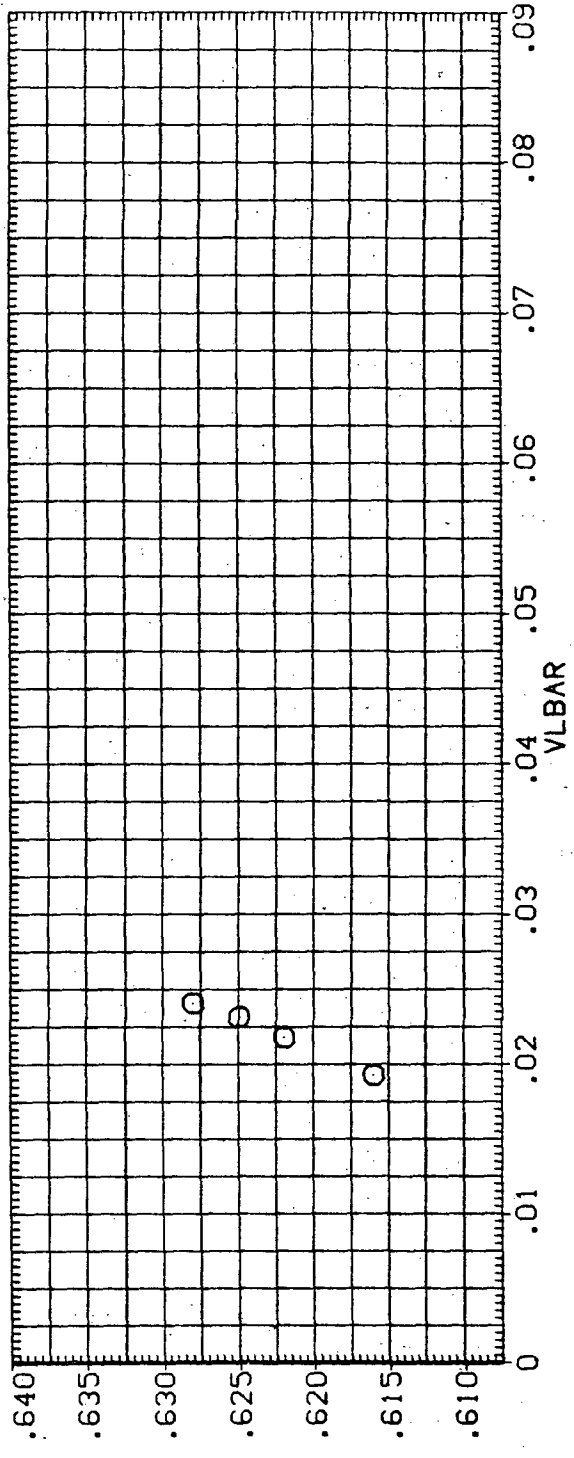
PARAMETRIC VALUES
.000 RN/L
.000 AILRON
.000 SPOBRK
.000 MACH

.500
.000
55.000
16.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XMRP 1076.7000 INCHES
YMRP .0000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100



2



3

FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0010)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L		SREF	LREF	SO.FT.	
○	30.000	ELEVTR	.000	.070	2690.0000	474.8000	INCHES	
□	35.000	RUDDER	.000	.000	936.7000	1076.7000	INCHES	
		BDFLAP	.000	20.000	375.0000		INCHES	
					ZMRP		INCHES	
					SCALE		.0100	

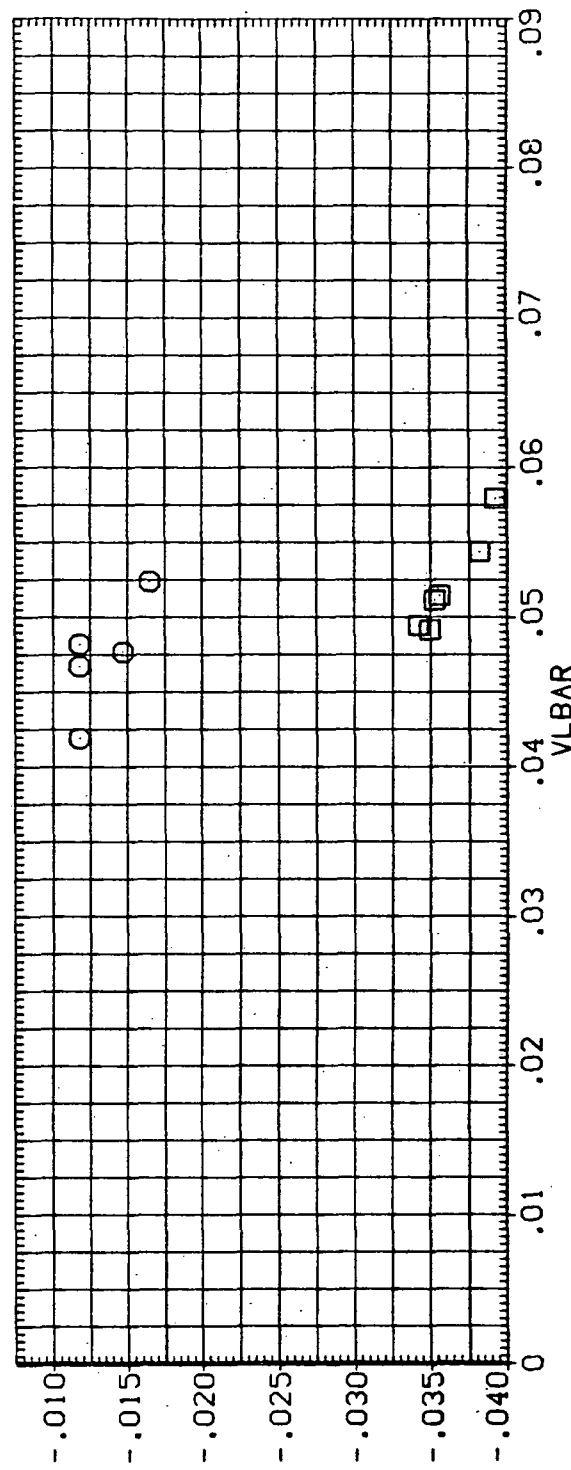
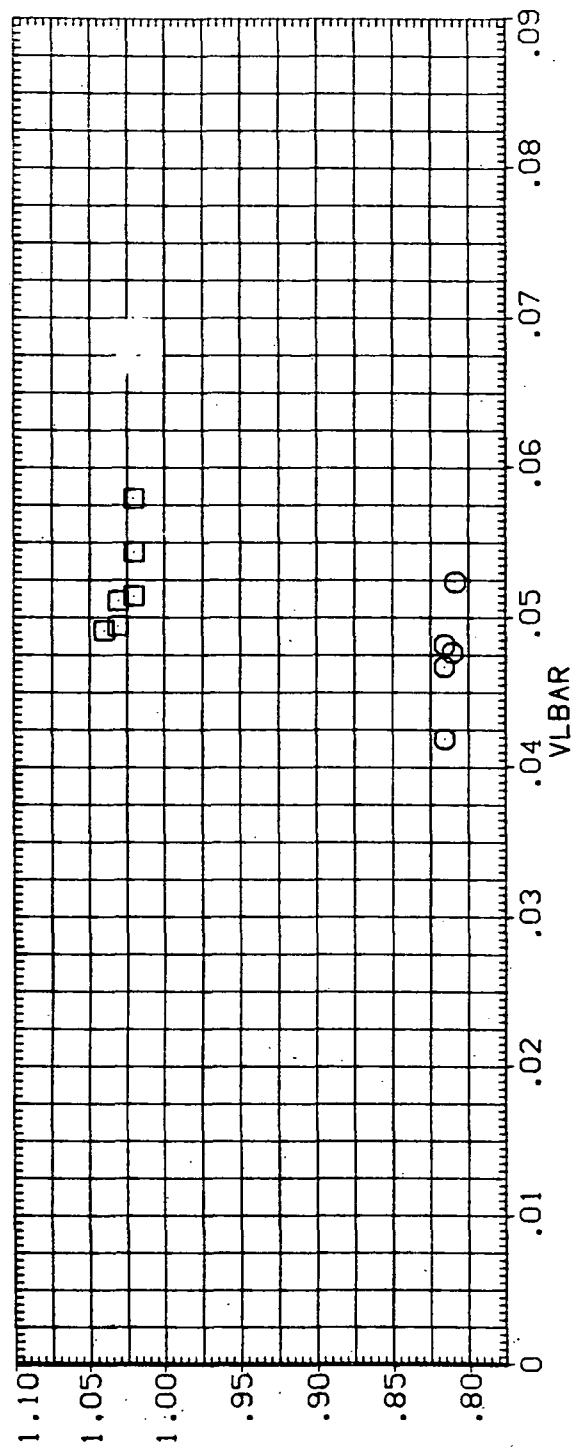


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
 ○
 □

ALPHA
 30.000
 35.000

BETA
 .000
 .000
 .000
 .000

ELEVTR
 .000
 .000
 .000
 .000

RUDDER
 .000
 .000
 .000
 .000

BDFLAP
 .000
 .000
 .000
 .000

PARAMETRIC VALUES
 RN/L .070
 AILRON .000
 SPDBRK 55.000
 MACH 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP .0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

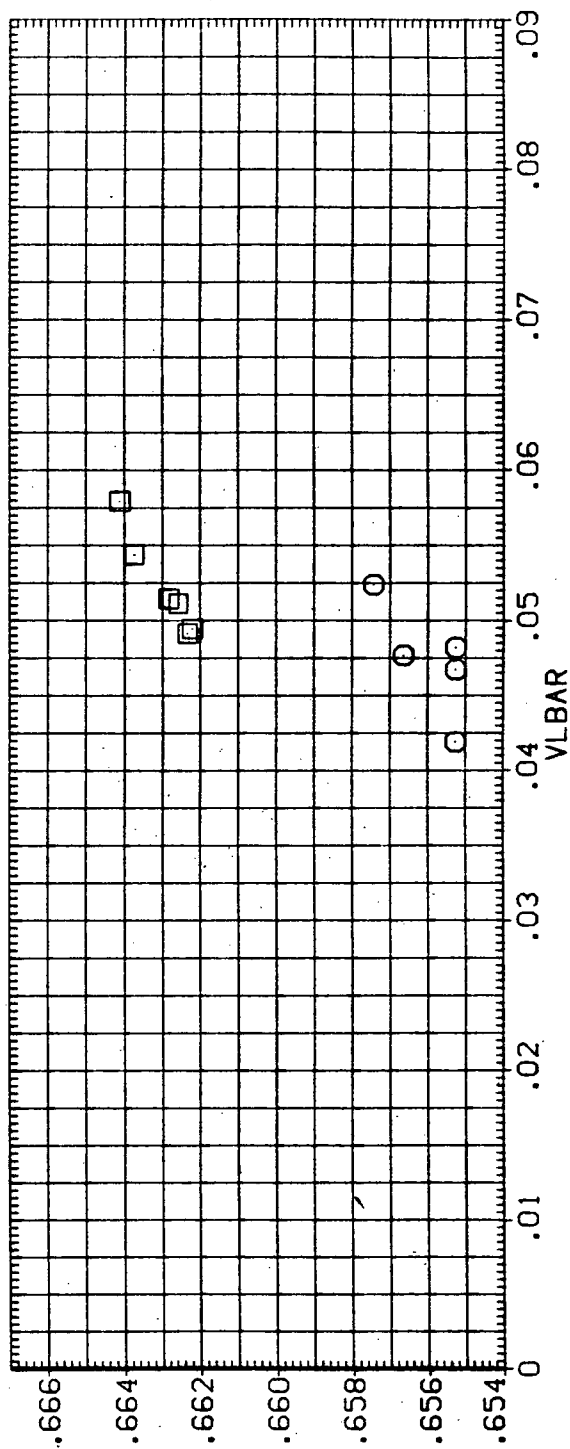
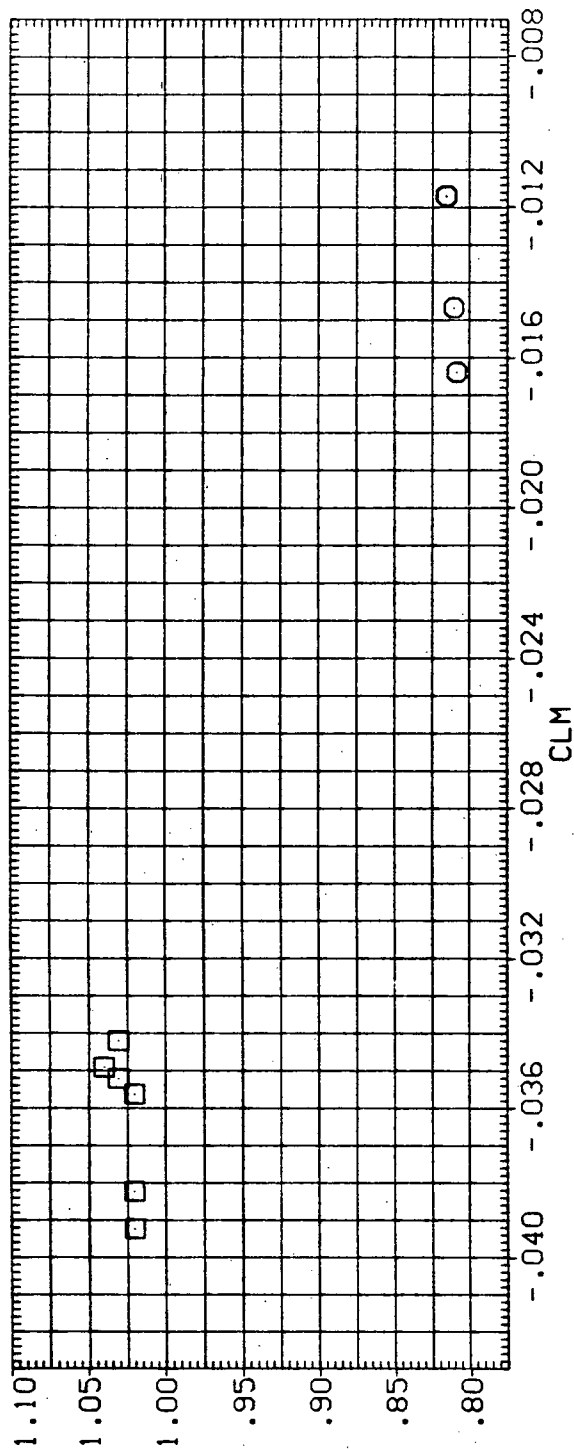


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0010)

SYMBOL
○
□

ALPHA 30.000 BETA .000 RN/L .070
35.000 ELEVTR .000 AILRON .000
RUDDER .000 SPOBRK 55.000
BOFLAP .000 MACH 20.000

PARAMETRIC VALUES

REFERENCE INFORMATION
SREF 2690.0000 SO.FT.
BREF 474.8000 INCHES
XMRP 936.7000 INCHES
YMRP 1076.7000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

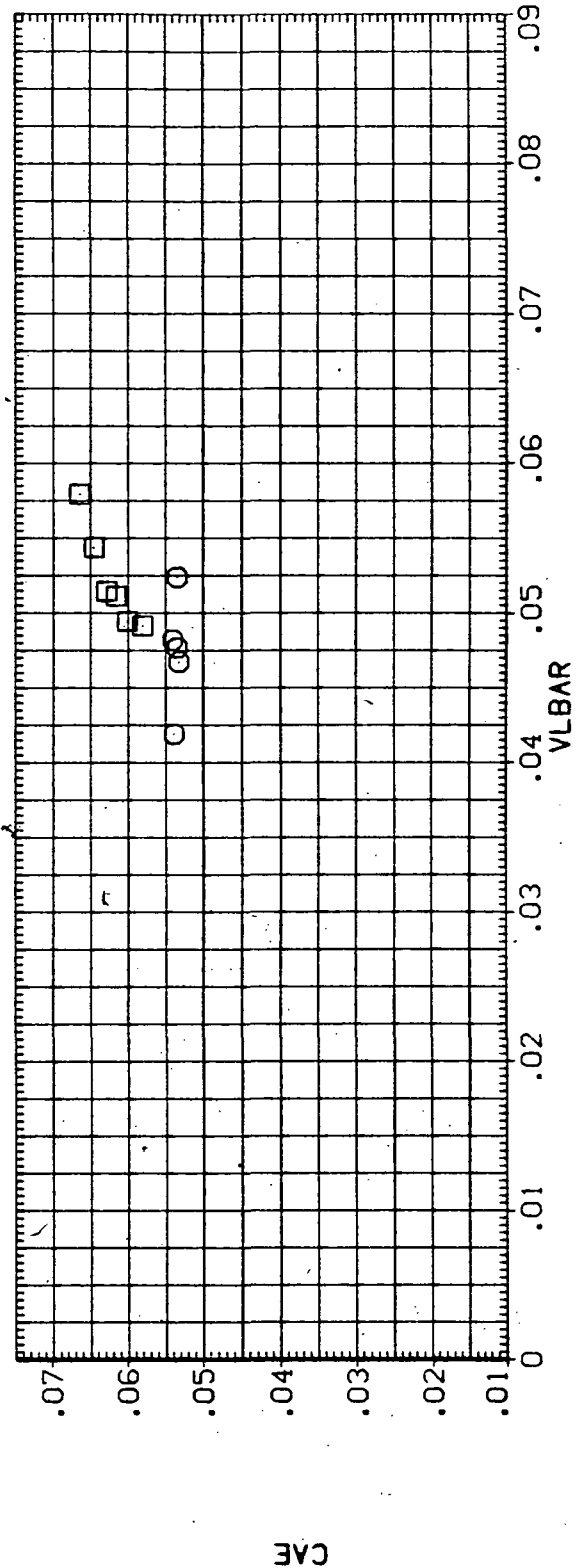
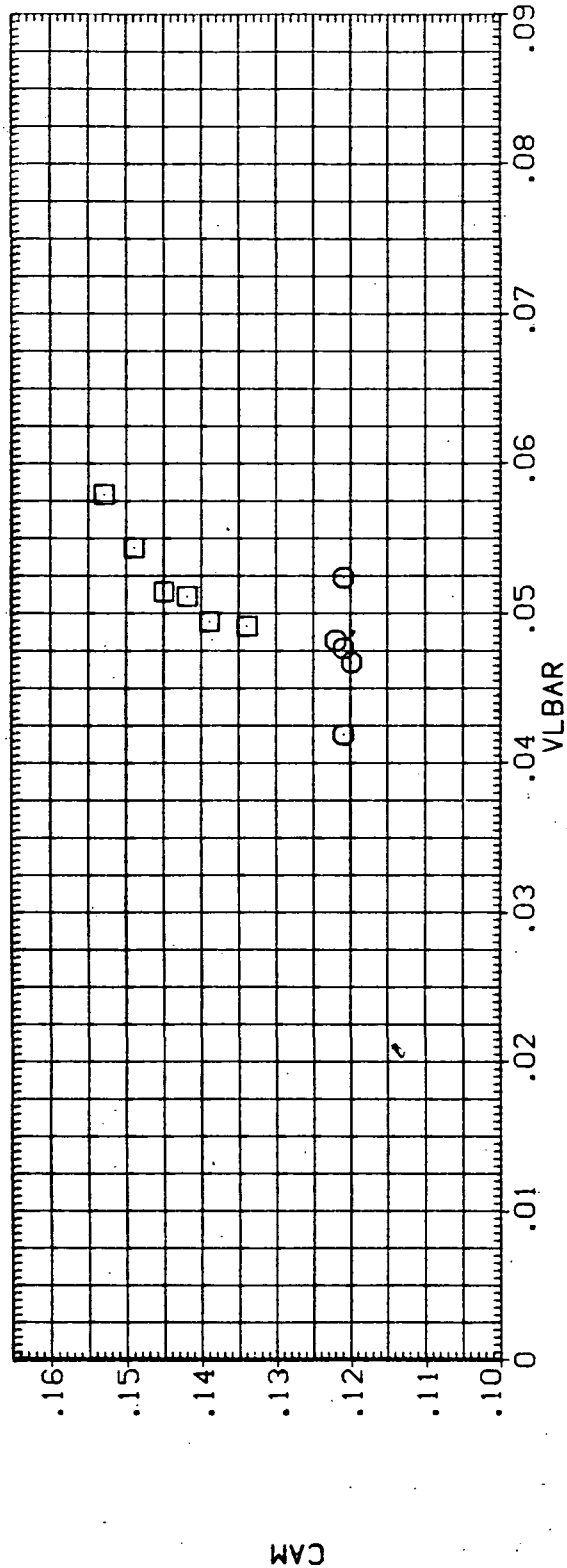


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL

○
□

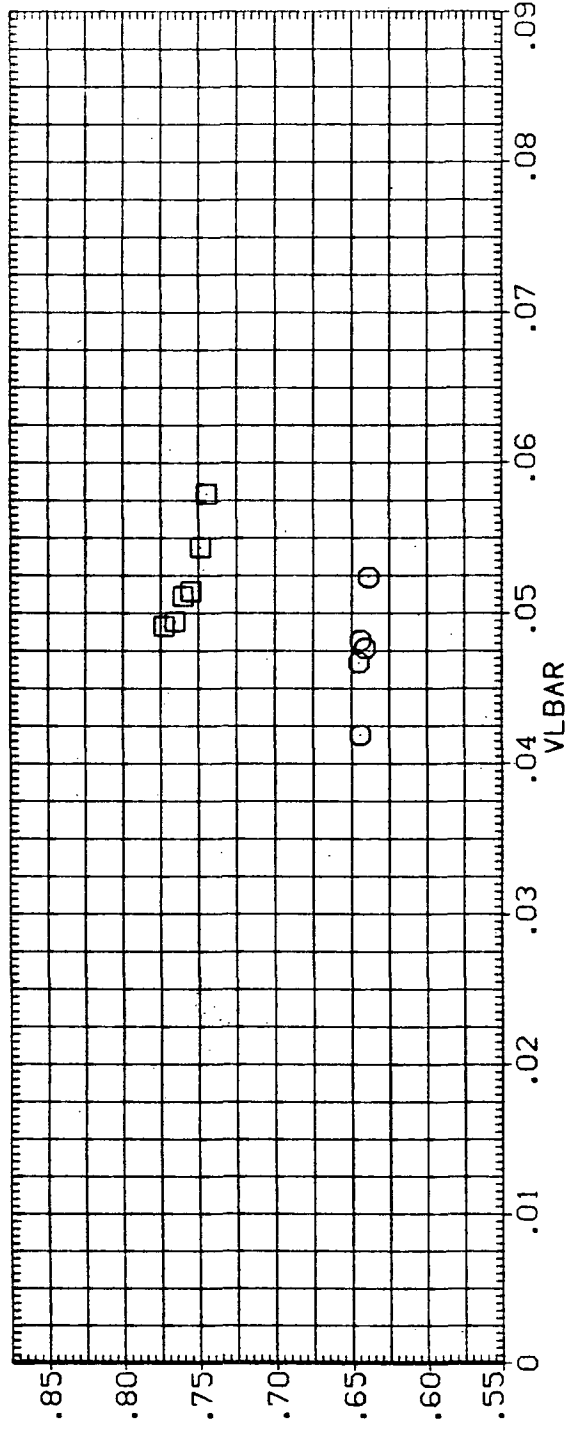
ALPHA
30.000
35.000

BETA
ELEVTR
RUDDER
BOFLAP

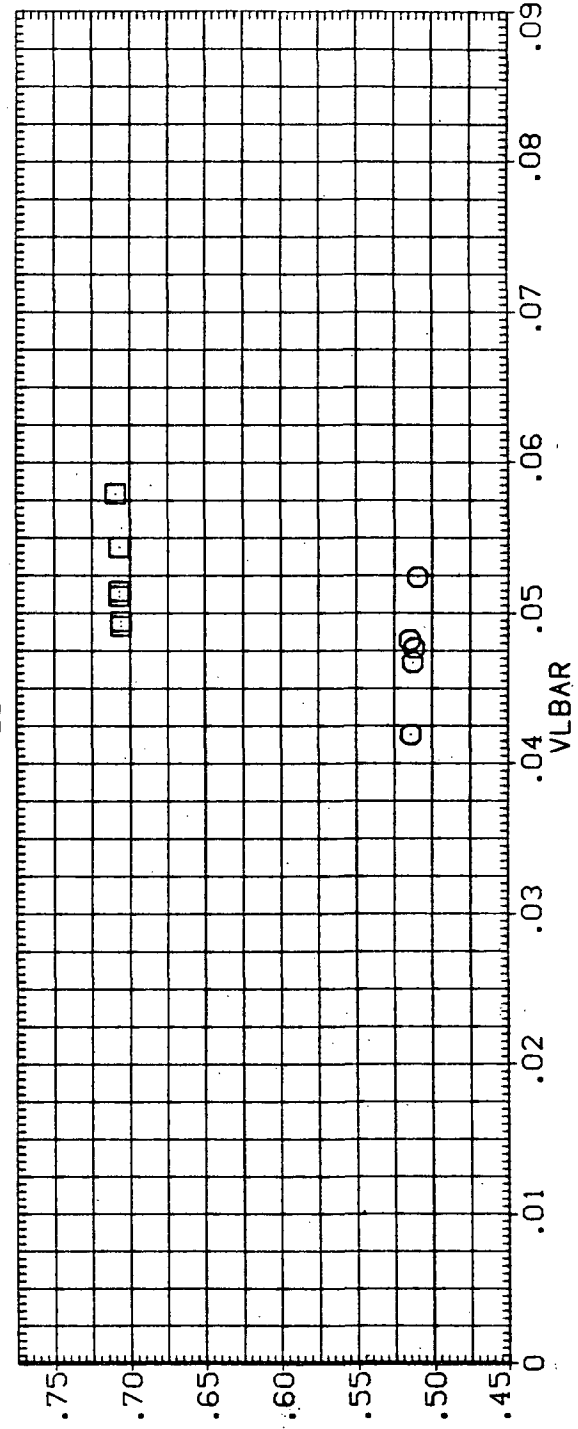
PARAMETRIC VALUES
.000 RN/L
.000 AILRON
.000 SPOBRK
.000 MACH

.070
.000
55.000
20.000

REFERENCE INFORMATION
SREF 2690.0000
LREF 474.8000
BREF 936.7000
XMRP 1076.7000
YMRP .0000
ZMRP 375.0000
SCALE .0100



13



13

FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(F10011)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	MACH	SREF	LREF	BREF	XMREF
○	25.000	.000	1.100	.000	2690.0000	474.8000	936.7000	1076.7000
□	30.000	.000	.000	55.000				
◇	35.000	16.300	16.000					
					YMRP	ZMRP	SCALE	

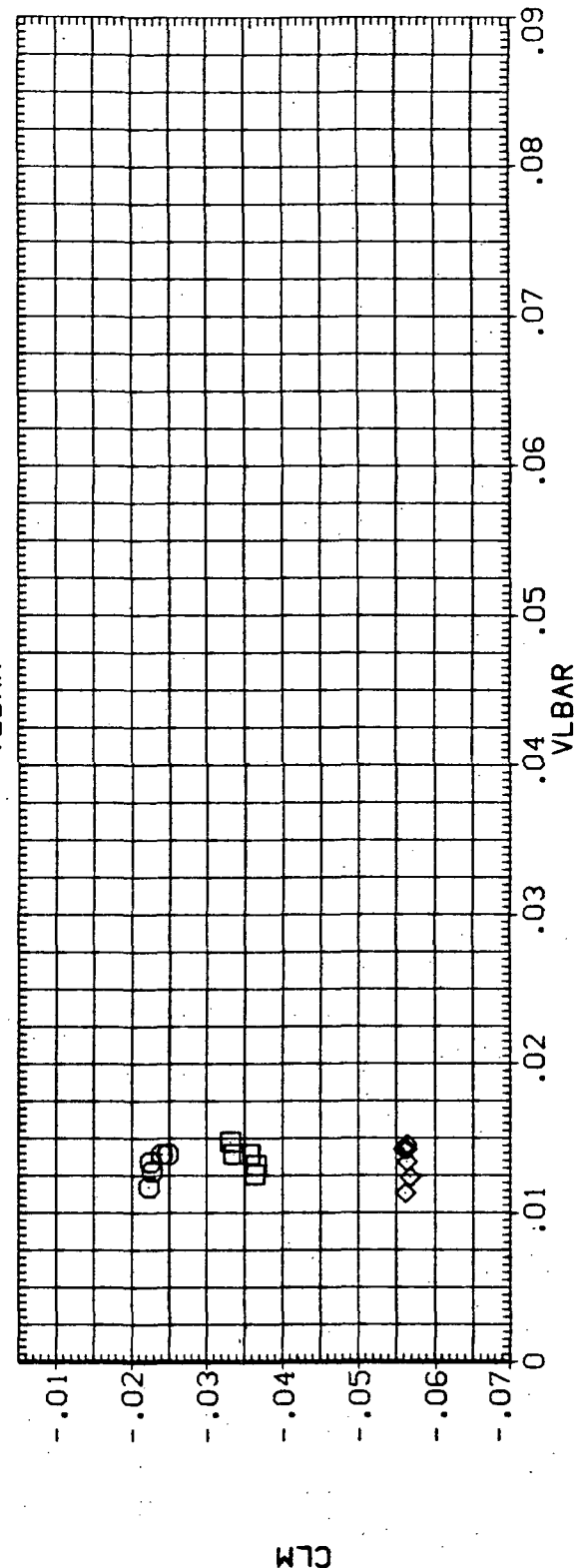
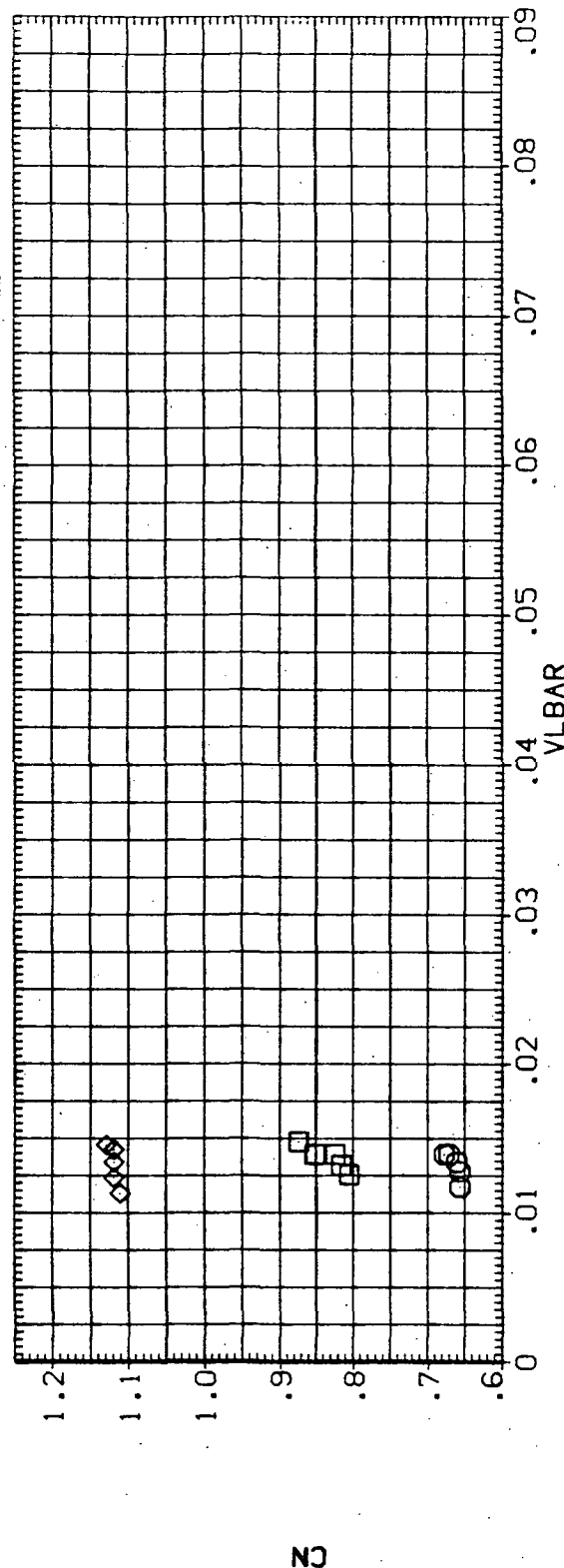


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	AILRON	SREF	LREF	SQ.FT.	
○	25.000	ELEVTR	.000	.000	BREF	474.8000	INCHES	
□	30.000	RUDDER	.000	SPDBRK	YMRP	936.7000	INCHES	
◇	35.000	BDFLAP	16.300	MACH	ZMRP	1076.7000	INCHES	
					SCALE	375.0000	INCHES	
						.0100		

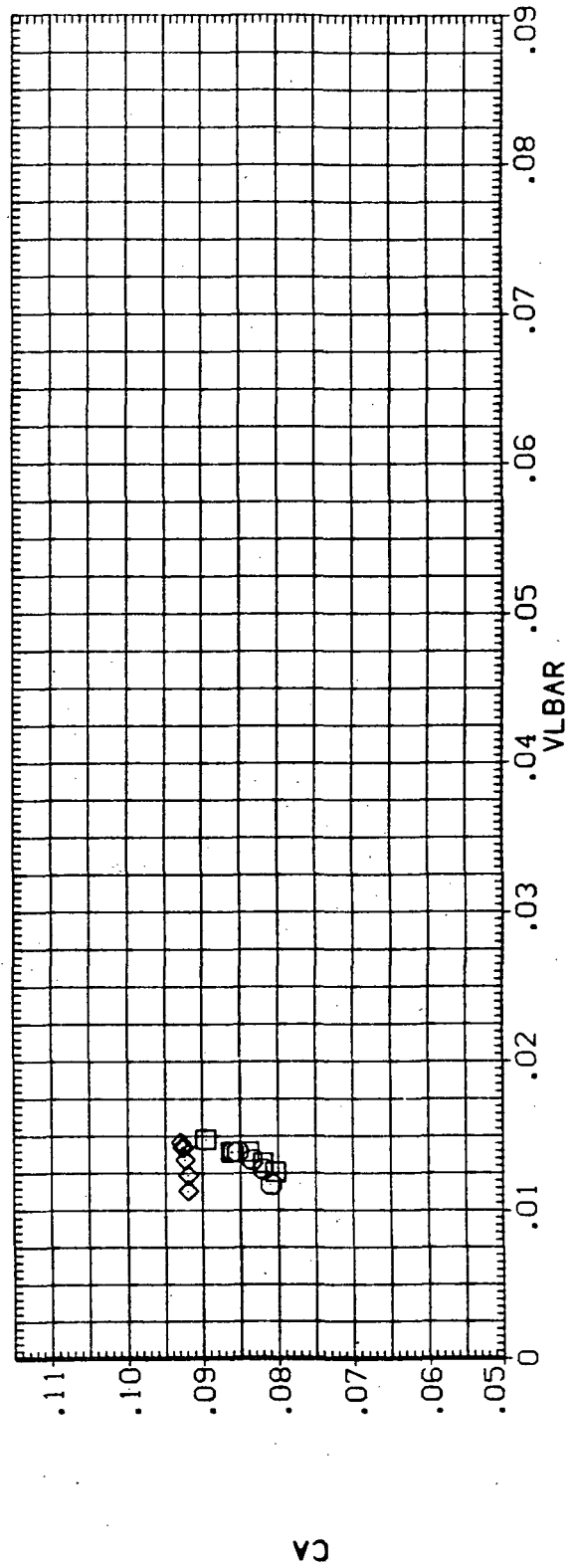
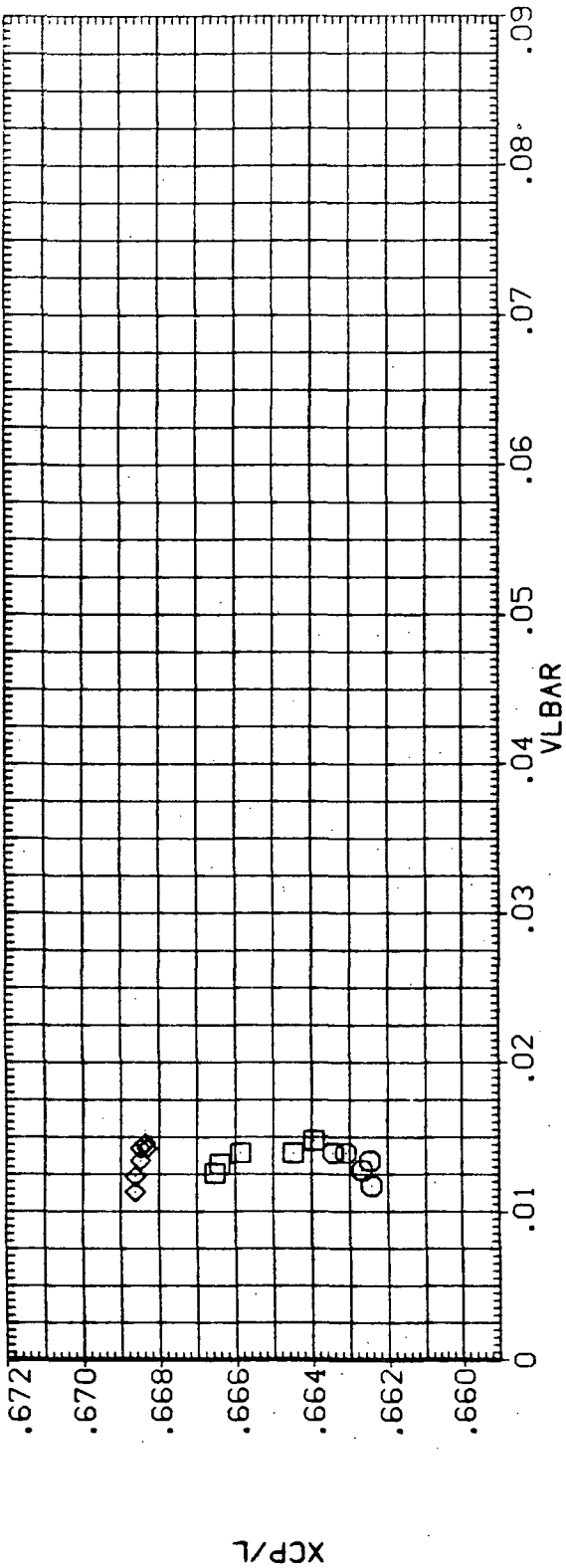


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0011)

SYMBOL

PARAMETRIC VALUES

REFERENCE INFORMATION

ALPHA	BETA	RN/L	1.100	SREF	2690.0000	50.FT.
25.000	ELEVTR	AILRON	.000	LREF	474.8000	INCHES
30.000	RUDDER	SPOBRK	.000	BREF	936.7000	INCHES
35.000	BDFLAP	MACH	16.300	YMRP	1076.7000	INCHES
				ZMRP	375.0000	INCHES
				SCALE	.0100	

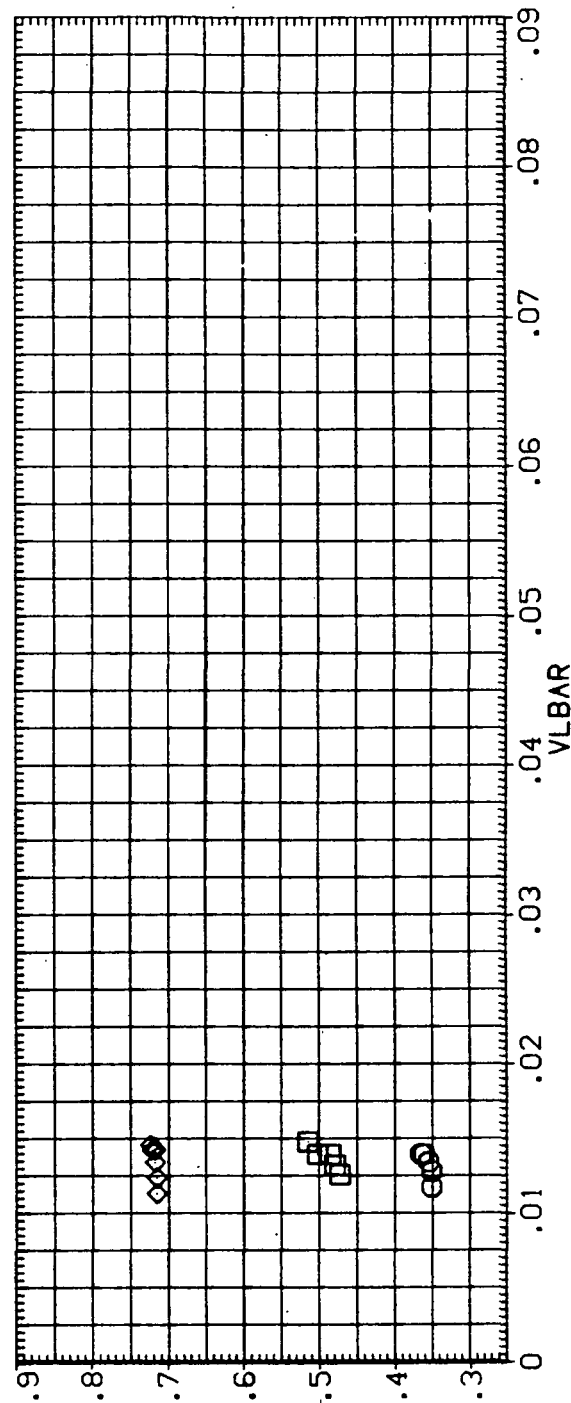
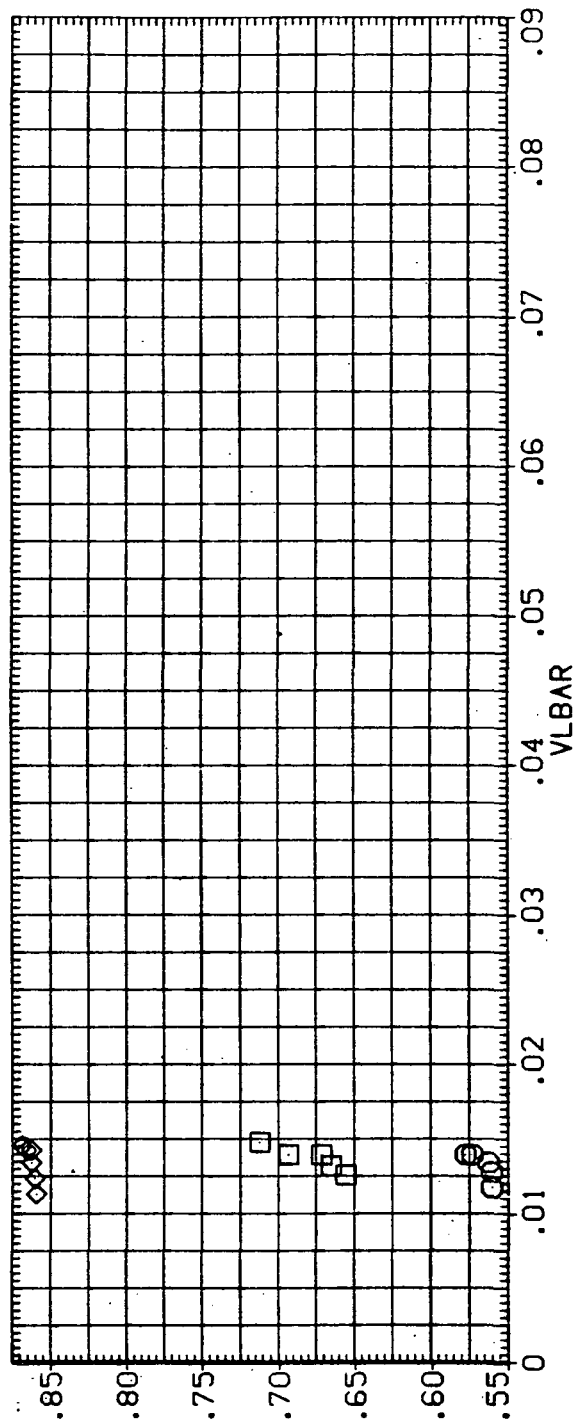


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	.000	RN/L	1.100	SREF	2690.0000	50. FT.
○	20.000	ELEVTR	15.000	AILRON	.000	LREF	474.8000	INCHES
□	25.000	RUDDER	.000	SPBRK	55.000	BREF	936.7000	INCHES
◇	30.000	BDFLAP	16.300	MACH	16.000	XMRP	1076.7000	INCHES
△	35.000					YMRP	.0000	INCHES
						ZMRP	375.0000	INCHES
						SCALE	.0100	

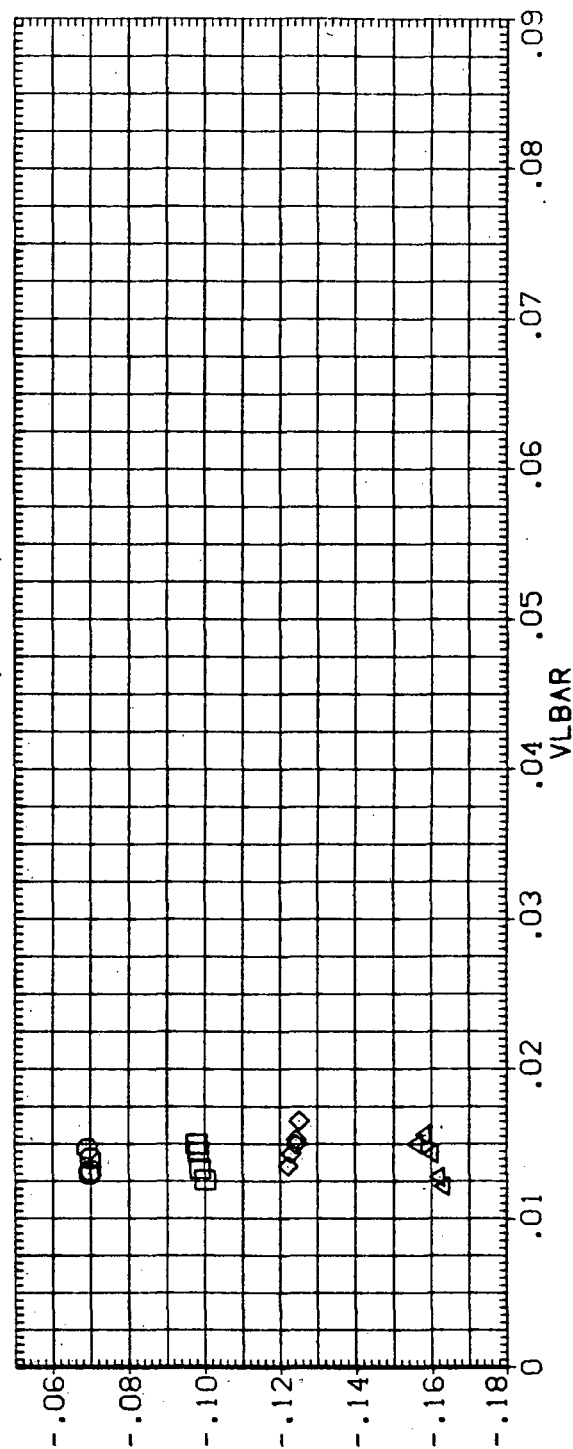
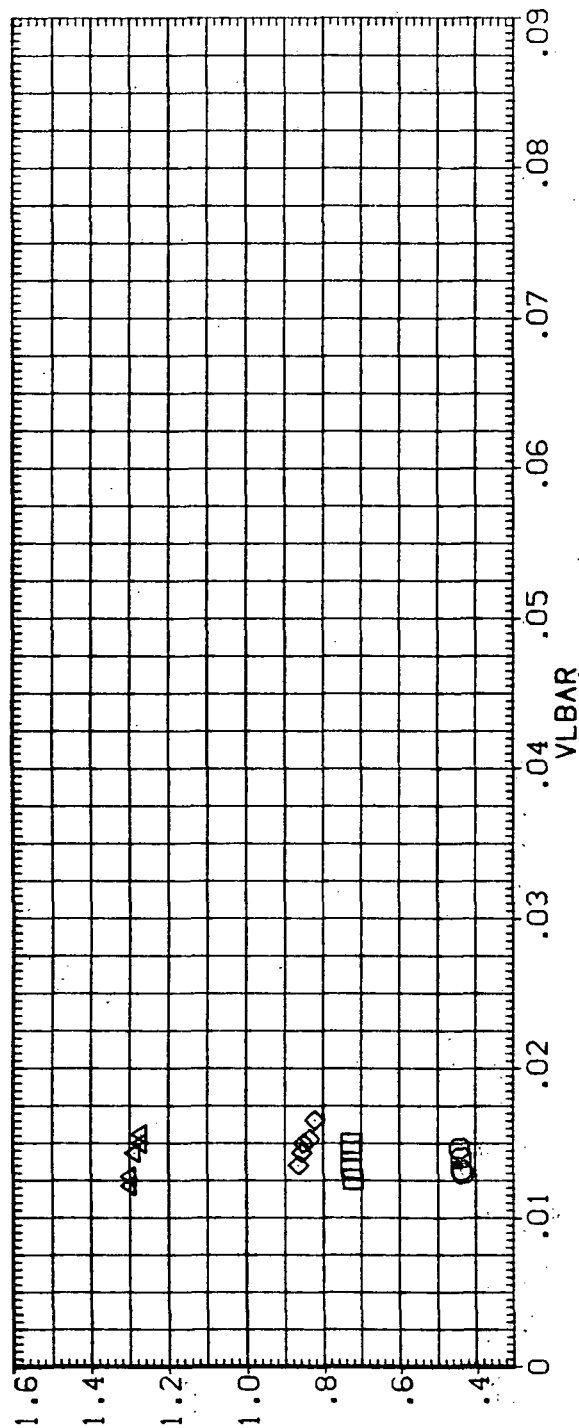


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0012)

PARAMETRIC VALUES		REFERENCE INFORMATION	
ALPHA	BETA	SREF	50. FT.
20.000	.000	LREF	INCHES
25.000	15.000	BREF	INCHES
30.000	.000	XMRP	INCHES
35.000	16.300	YMRP	INCHES
		ZMRP	INCHES
		SCALE	.0100

PARAMETRIC VALUES	
RN/L	1.100
AILRON	.000
SPDBRK	55.000
MACH	16.000

SYMBOL	
○	
□	
◇	
△	

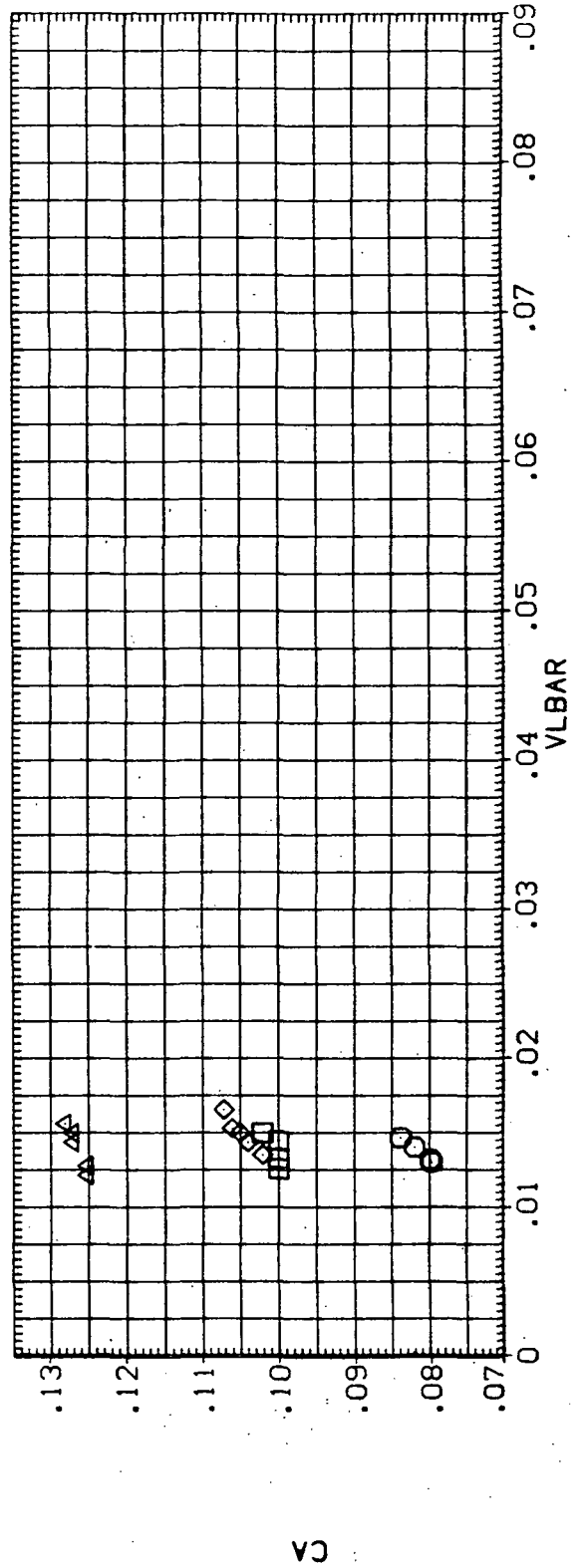
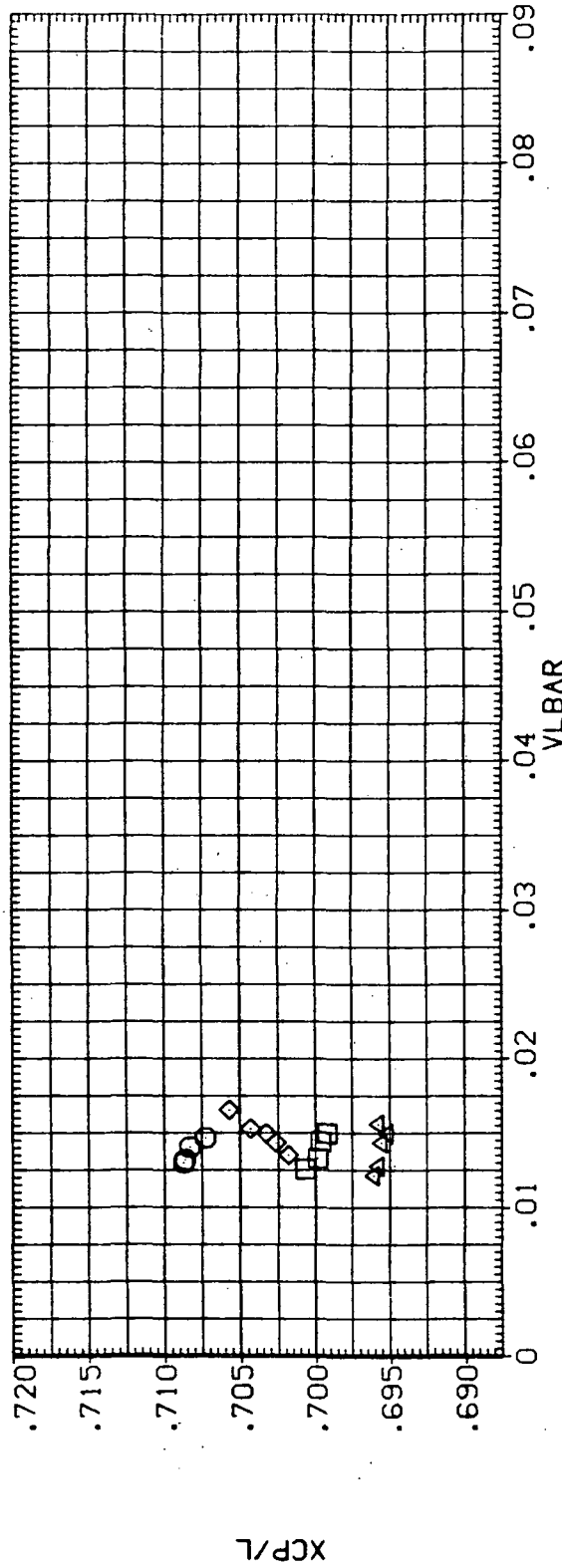


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
 ○ □ ◇ △

ALPHA
 20.000
 25.000
 30.000
 35.000

BETA
 .000
 15.000
 .000
 16.300

PARAMETRIC VALUES
 RN/L
 AILRON
 SPOBRK
 MACH

1.100
 .000
 55.000
 16.000

REFERENCE INFORMATION
 SREF 2690.0000 SQ.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP .0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

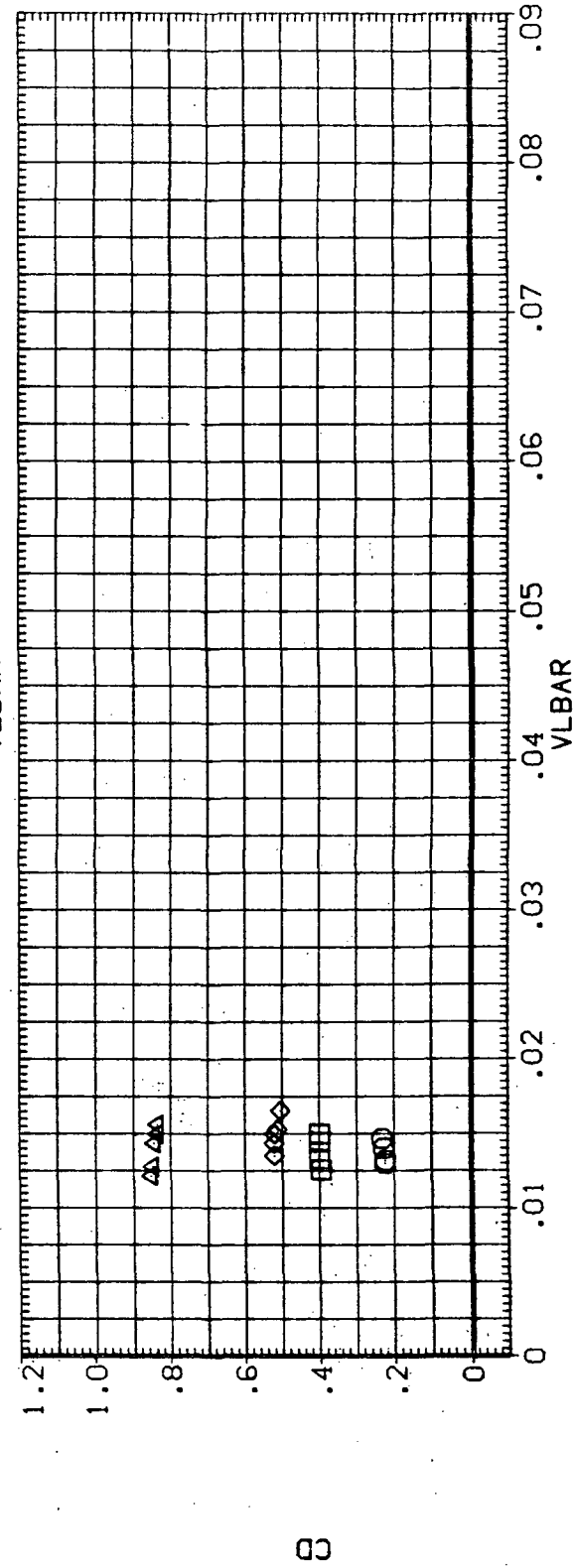
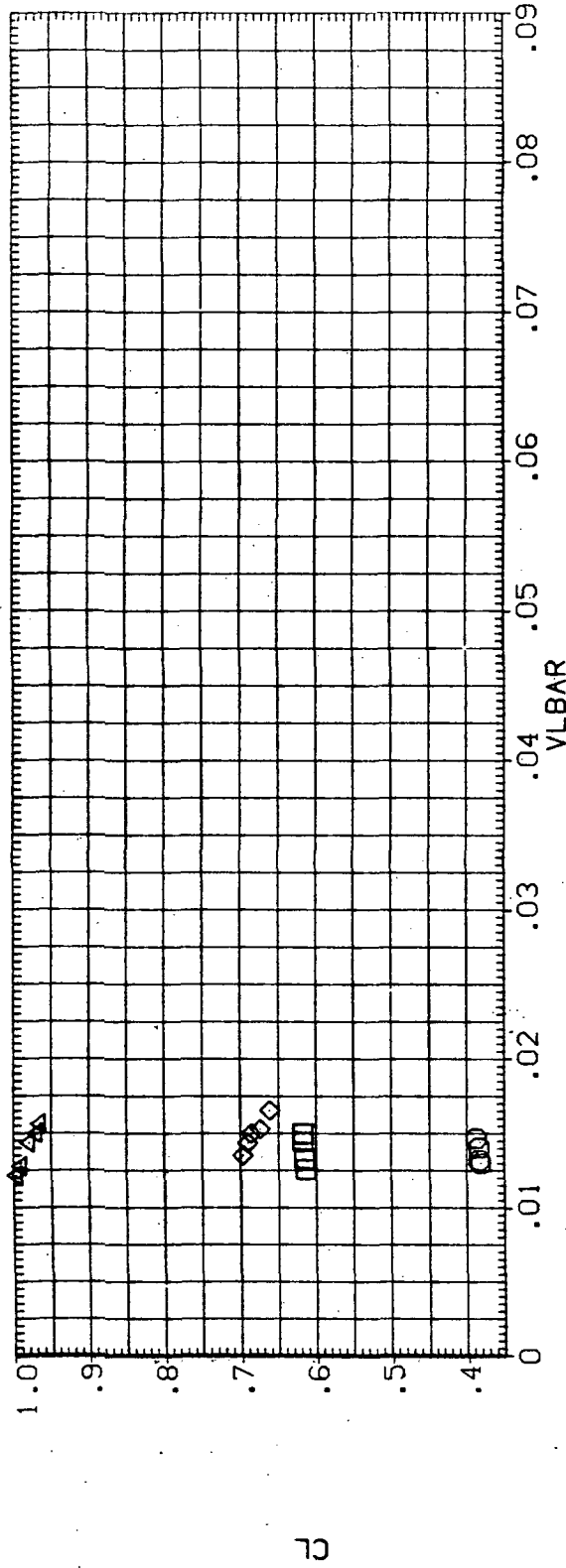


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0013)

PARAMETRIC VALUES		REFERENCE INFORMATION	
ALPHA	BETA	SREF	2690.0000
20.000	.000	LREF	474.8000
25.000	15.000	BREF	936.7000
30.000	.000	YMRP	1076.7000
35.000	16.300	ZMRP	375.0000
		SCALE	.0100

SYMBOL	PARAMETRIC VALUES
○	RN/L
□	AILRON
◇	SPDBRK
△	MACH

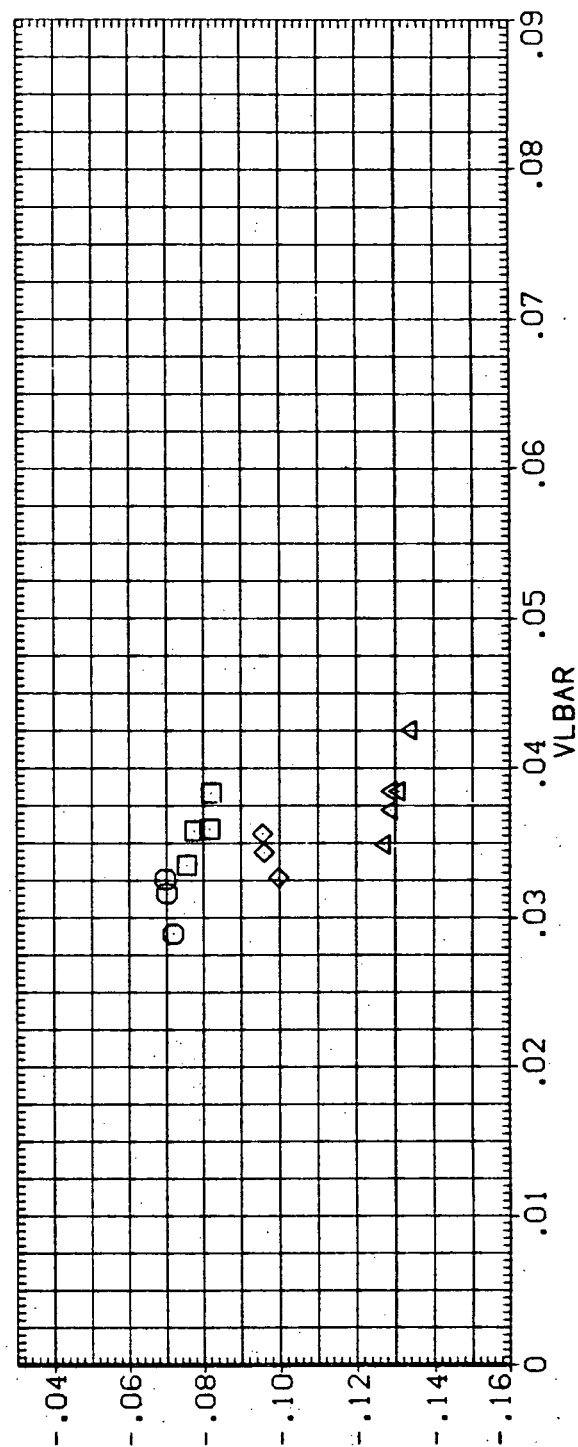
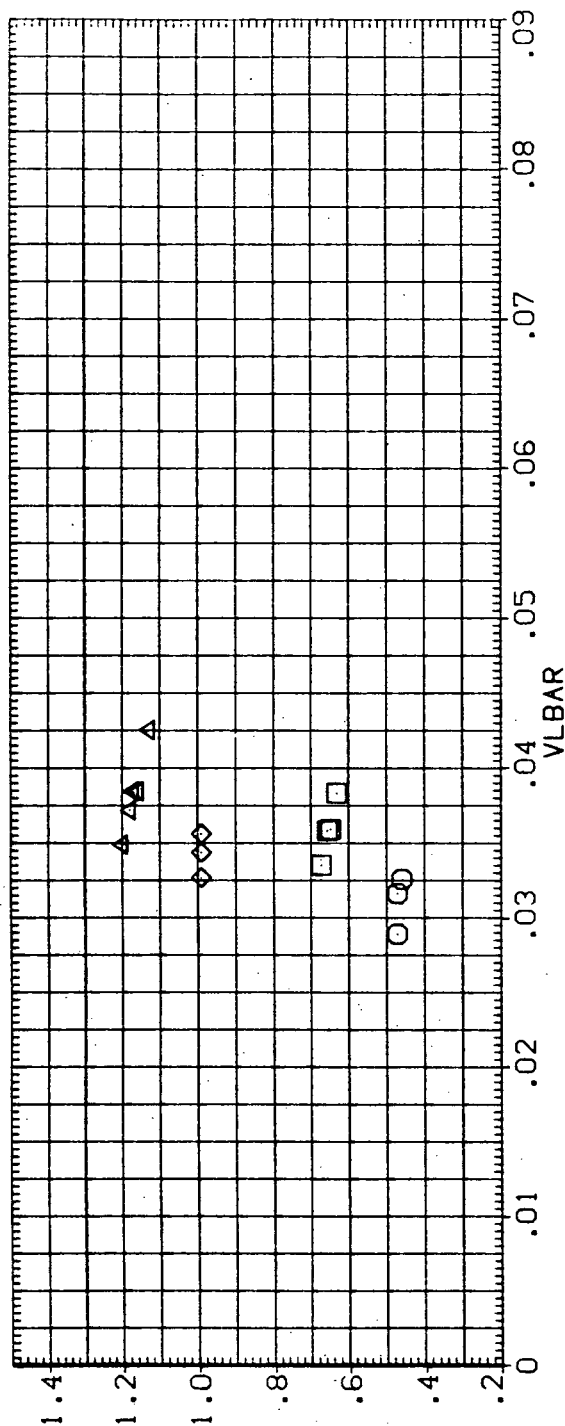


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL

○ □ ◇ △

PARAMETRIC VALUES

ALPHA	BETA	0.000	RN/L	.250
20.000	ELEVTR	15.000	ALLRON	.000
25.000	RUDDER	.000	SPDBRK	55.000
30.000	BDFLAP	16.300	MACH	20.000

REFERENCE INFORMATION

SREF	2690.0000	SO.FT.
LREF	474.8000	INCHES
BREF	936.7000	INCHES
XMRP	1076.7000	INCHES
YMRP	.0000	INCHES
ZMRP	375.0000	INCHES
SCALE	.0100	

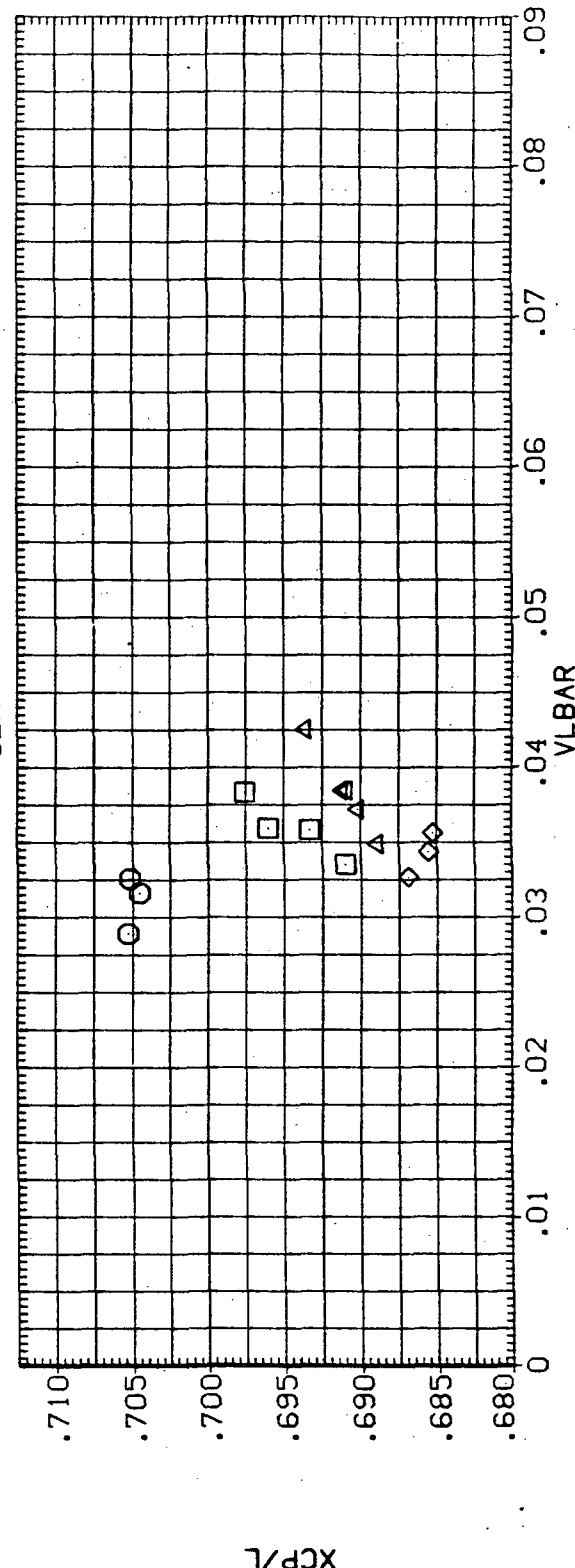
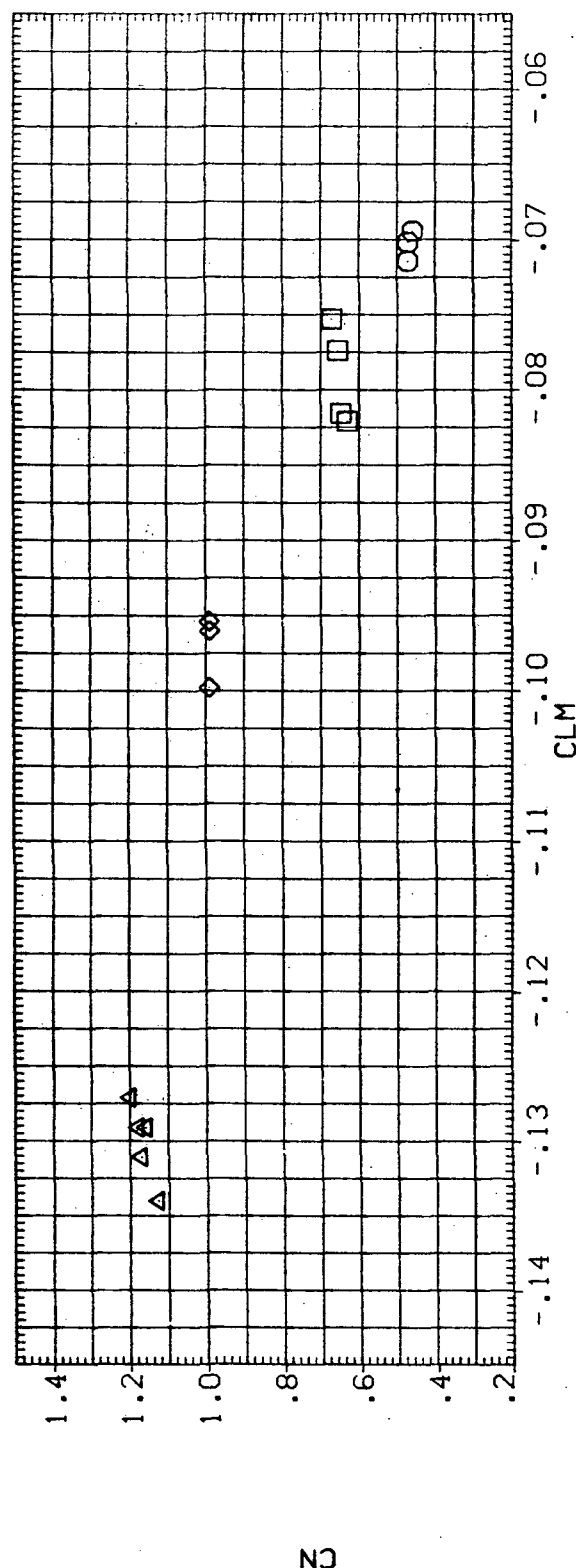


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)(FT0013)

SYMBOL
 ○
 □
 ◇
 △

ALPHA
 20.000
 25.000
 30.000
 35.000

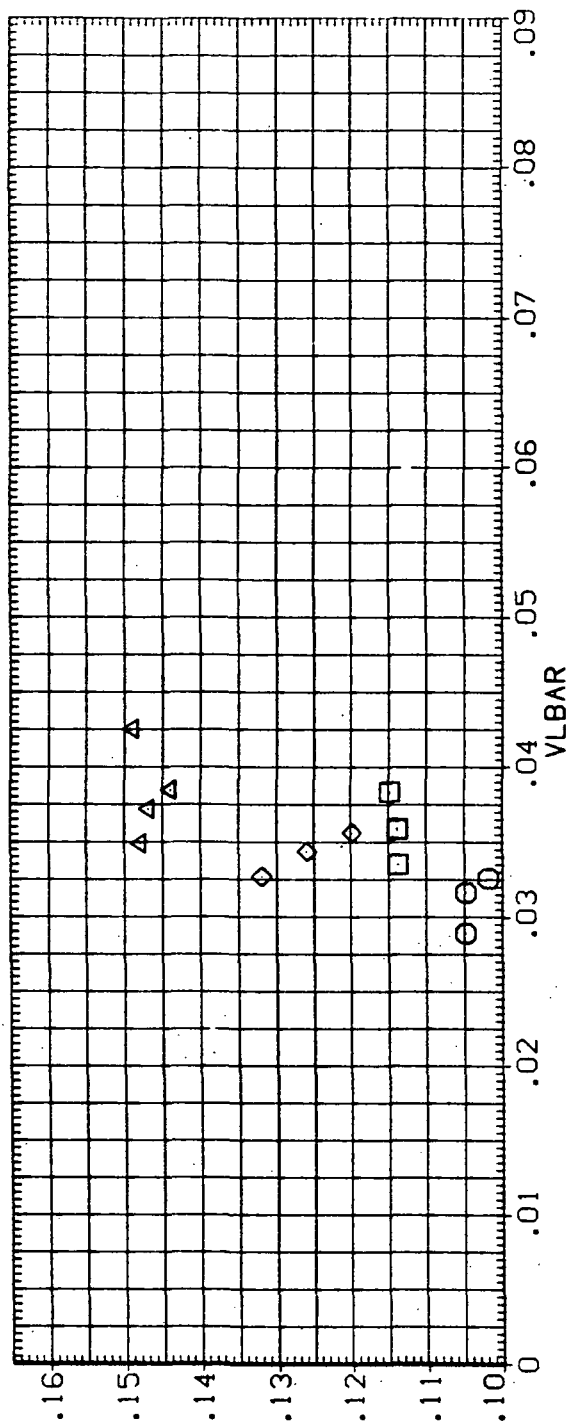
BETA
 .000
 15.000
 .000
 16.300

PARAMETRIC VALUES
 RN/L
 ALLRON
 SPDRK
 MACH

.250
 .000
 55.000
 20.000

REFERENCE INFORMATION
 SREF 2690.0000 SO.FT.
 LREF 474.8000 INCHES
 BREF 936.7000 INCHES
 XMRP 1076.7000 INCHES
 YMRP .0000 INCHES
 ZMRP 375.0000 INCHES
 SCALE .0100

CAM



CAE

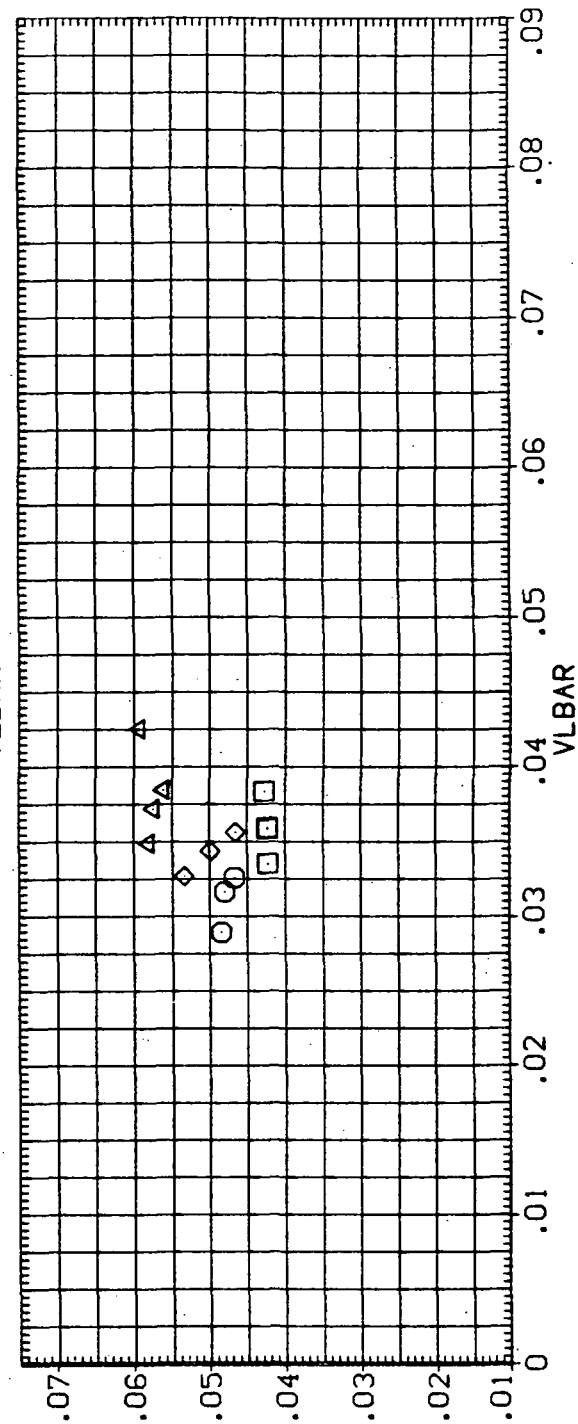


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
○ □ ◇ △

ALPHA
20.000
25.000
30.000
35.000

BETA
ELEVTR
RUDDER
BDFLAP

PARAMETRIC VALUES
.000 RN/L
15.000 AILRON
.000 SPDBRK
16.300 MACH

.250
.000
55.000
20.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XHRP 1076.7000 INCHES
YHRP .0000 INCHES
ZHRP 375.0000 INCHES
SCALE .0100

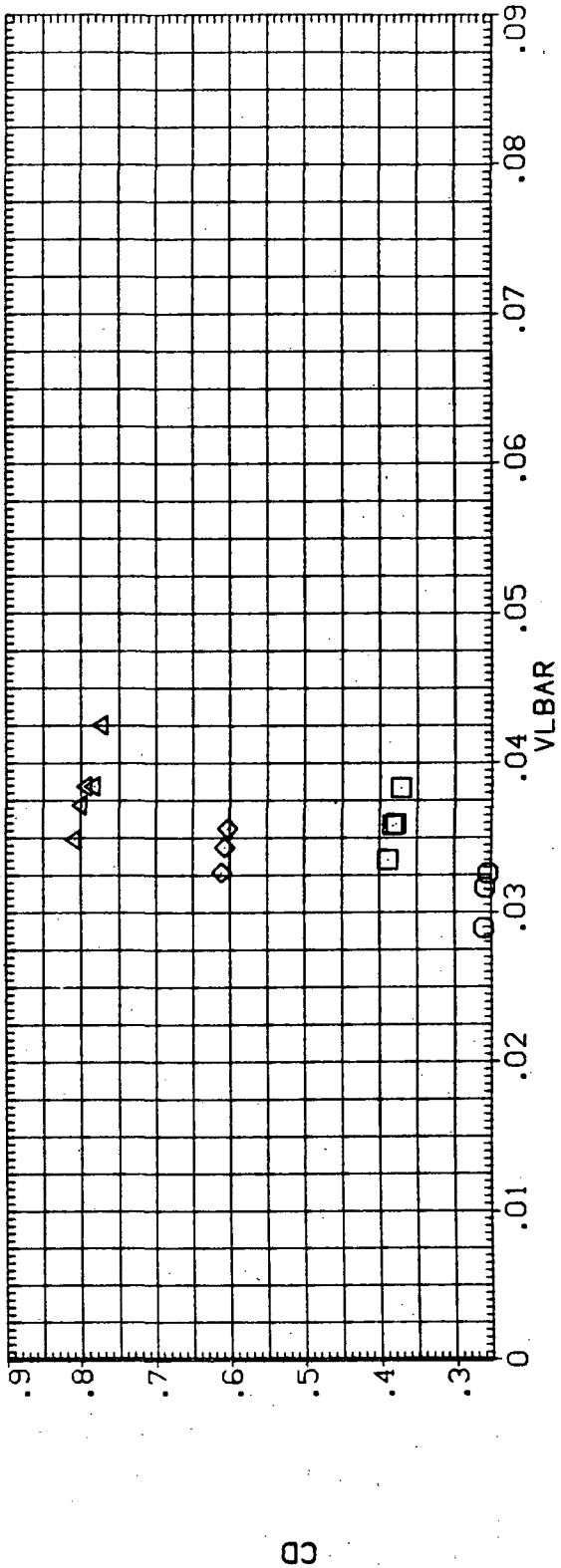
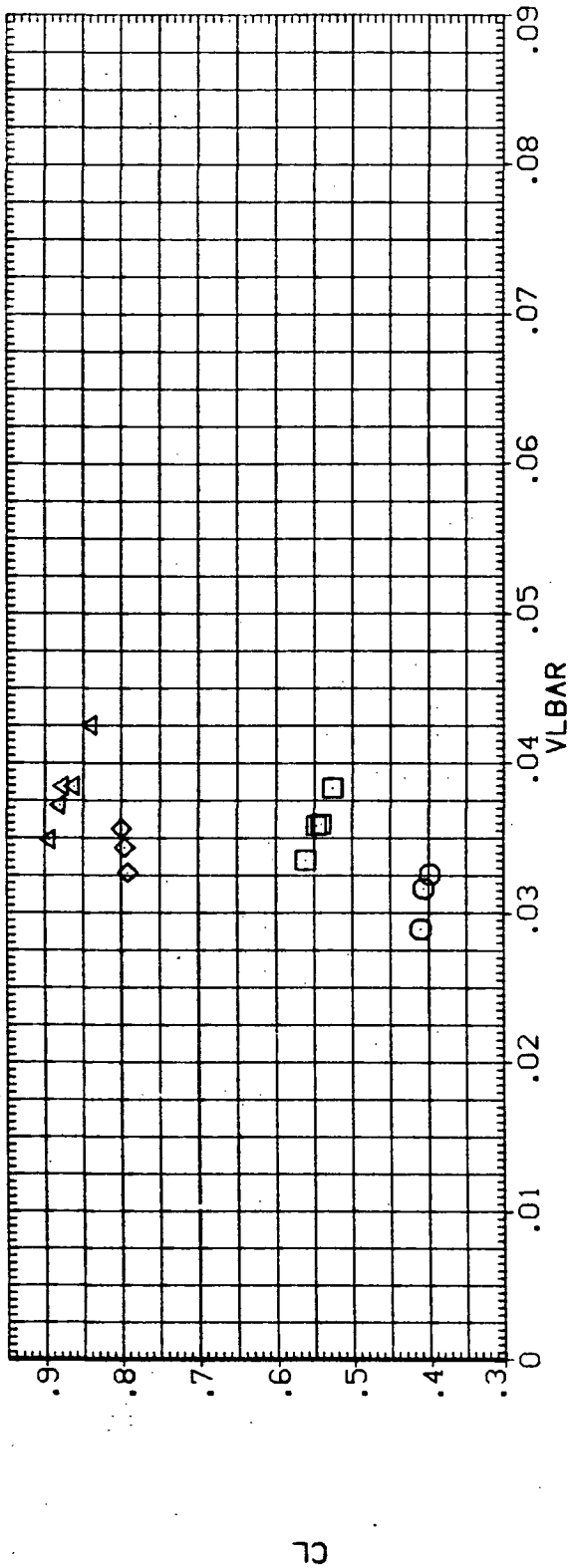


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC489(0A81) B26C9F7M7N28 W116E26 V8R5 INVERTED(FT0014)

PARAMETRIC VALUES		REFERENCE INFORMATION	
ALPHA	BETA	SREF	2690.0000
25.000	ELEVTR	LREF	474.8000
35.000	RUDDER	BREF	936.7000
	BDCLAP	XMRP	1076.7000
		YMRP	.0000
		ZMRP	375.0000
		SCALE	.0100

PARAMETRIC VALUES	
RN/L	1.100
AILRON	.000
SPDBRK	55.000
MACH	16.000

SYMBOL
○
□

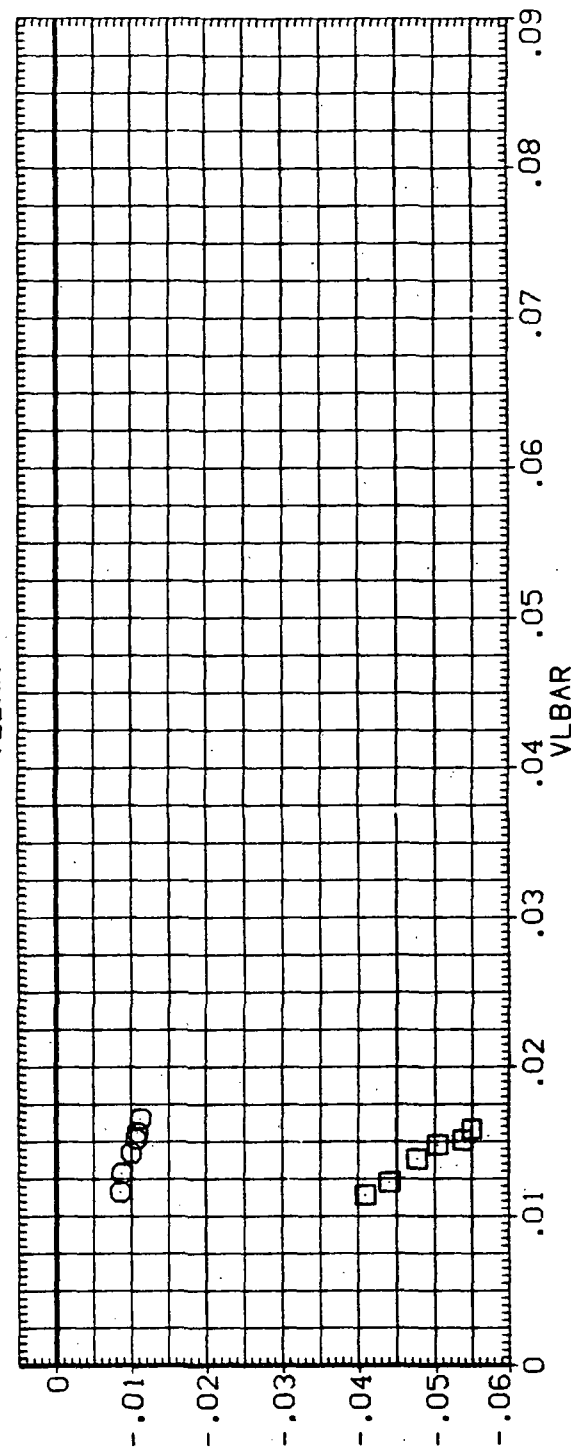
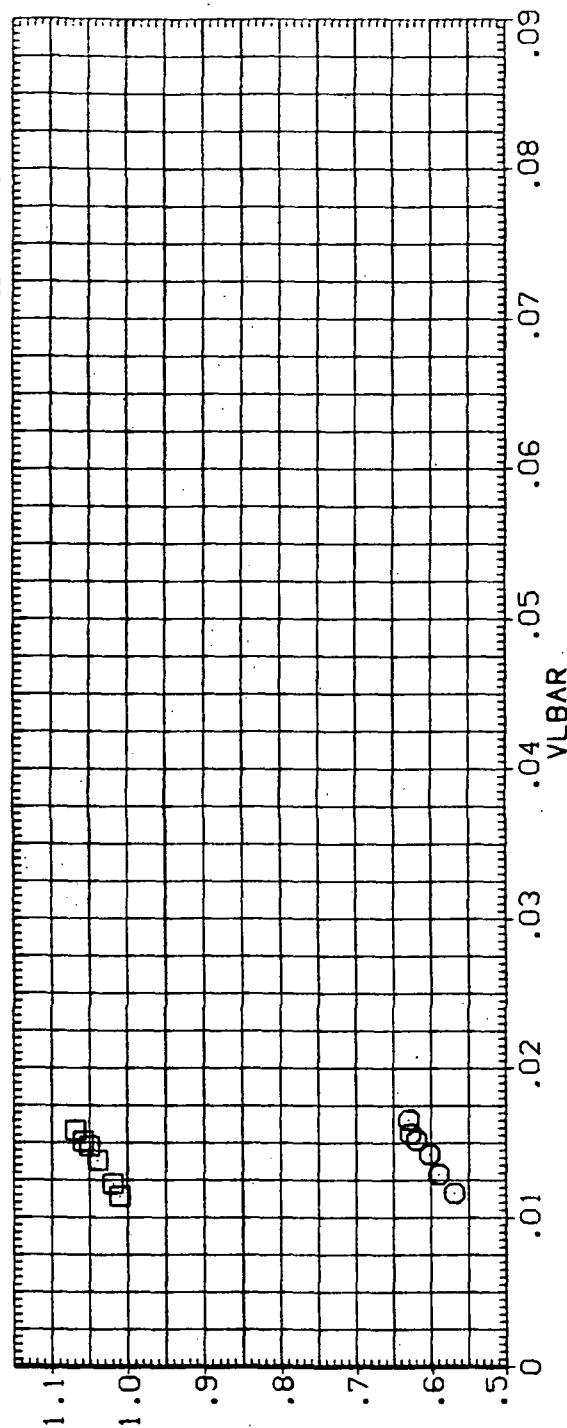


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL
○
□

PARAMETRIC VALUES
ALPHA 25.000 BETA .000 RN/L 1.100
35.000 ELEVTR .000 ALLRON .000
RUDDER .000 SPOBRK 55.000
BDFLAP -11.700 MACH 16.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XHRP 1076.7000 INCHES
YMRP .0000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

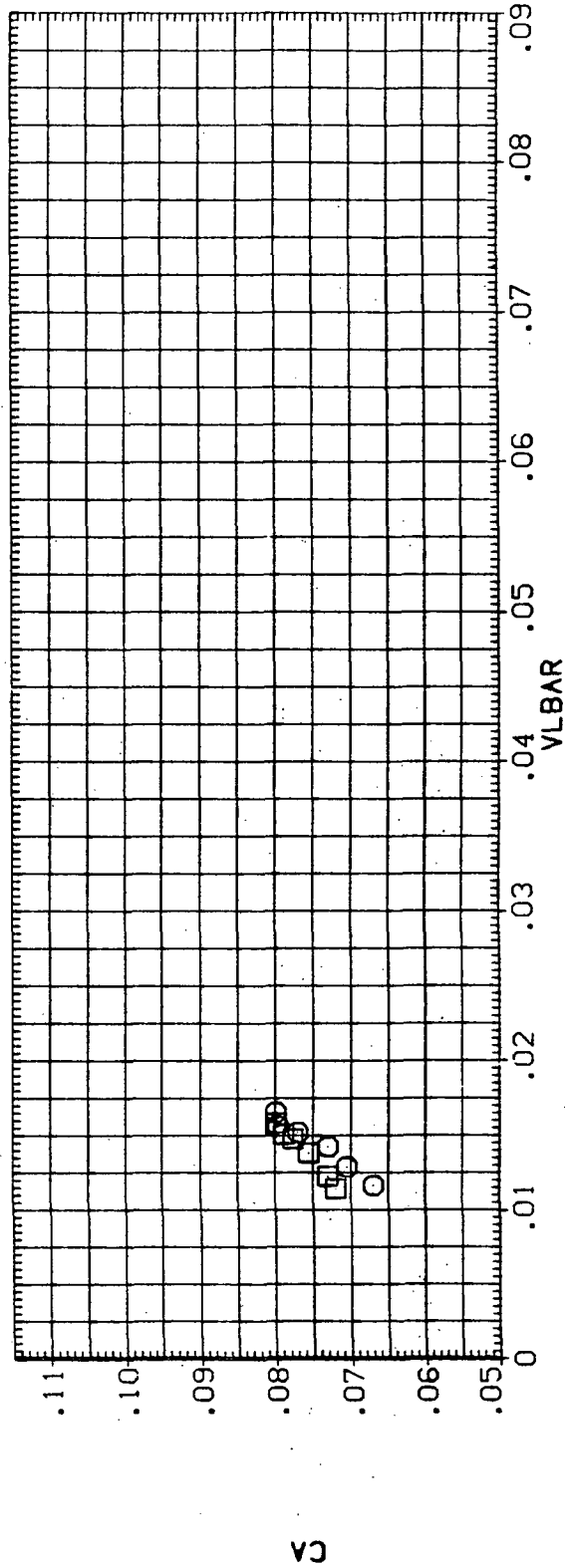
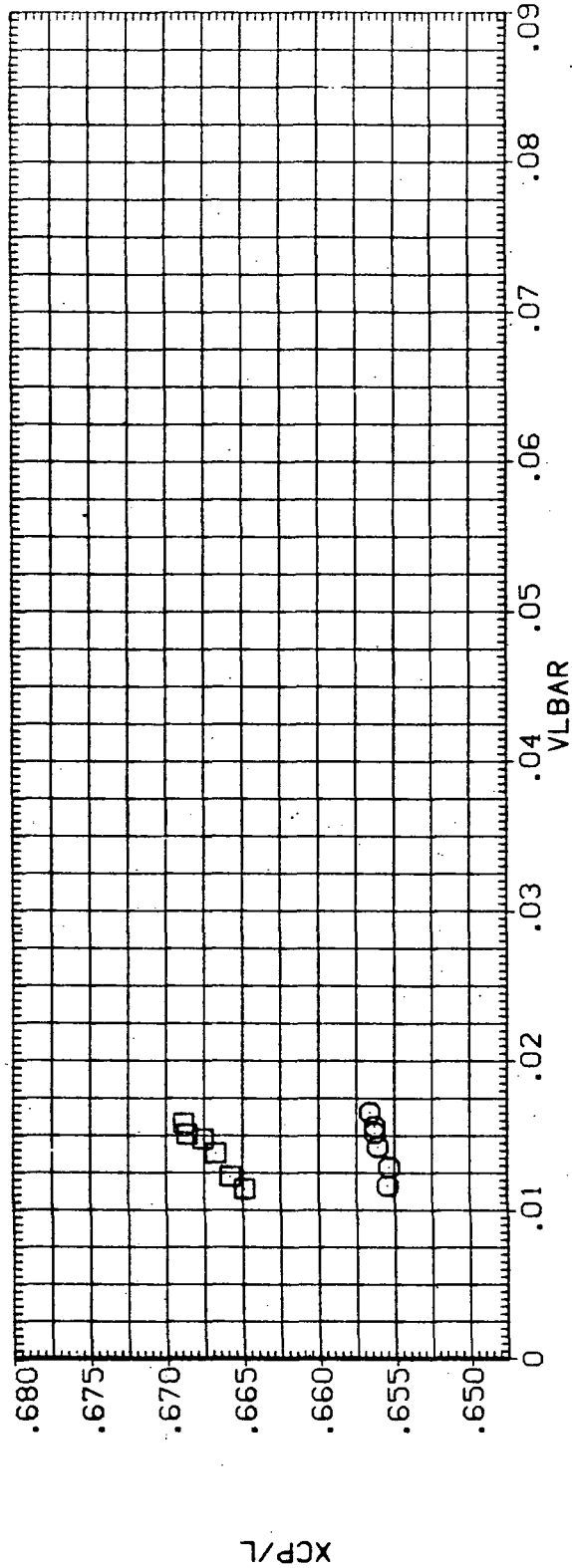


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC489(0A81) B26C9F7M7N28 W116E26 V8R5 INVERTED(FT0014)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	RN/L	MACH	SREF	LREF	SO.FT.	
○	25.000	.000	1.100	.000	2690.0000	474.8000	INCHES	
□	35.000	.000	.000	.000	936.7000	1076.7000	INCHES	
		RUDDER	SPDRK		XMRP		INCHES	
		BOFLAP	MACH		ZMRP		INCHES	
					SCALE		INCHES	
							.0100	

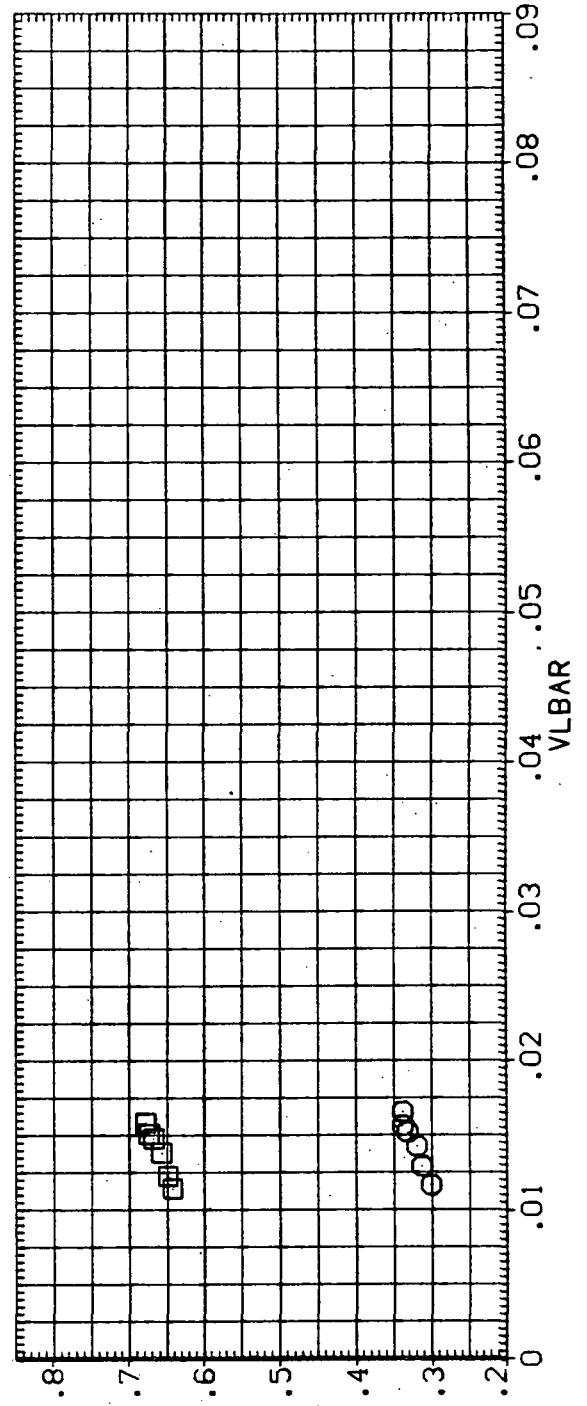
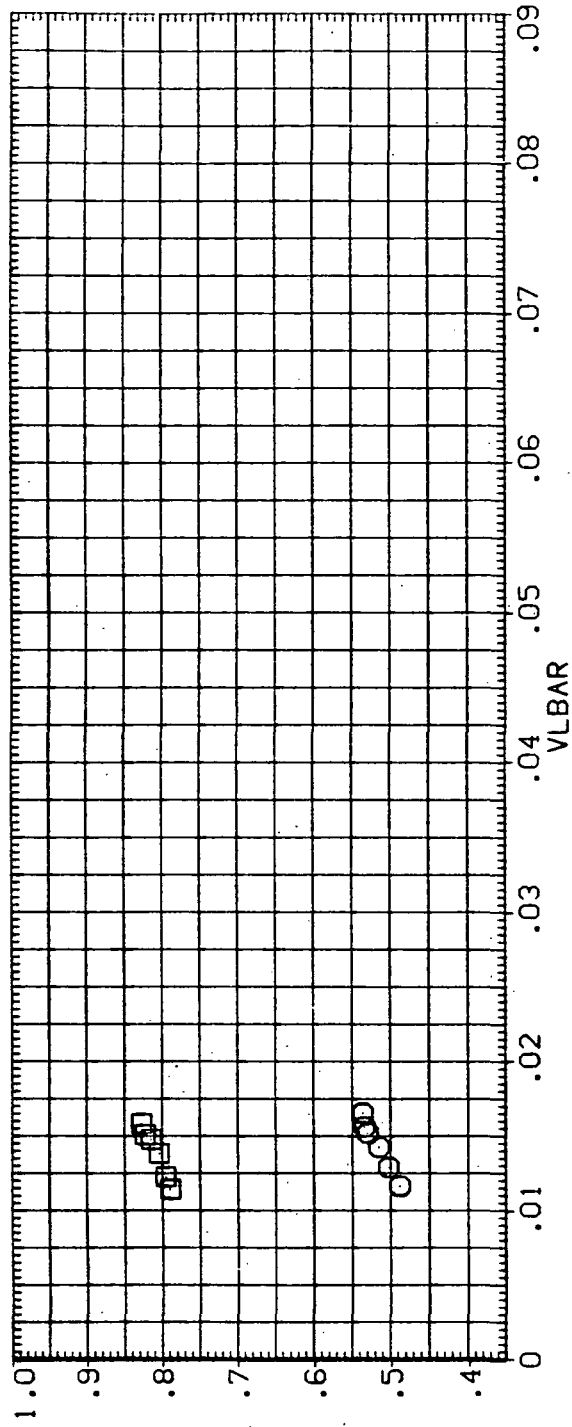


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	ALPHA		BETA		PARAMETRIC VALUES		REFERENCE INFORMATION	
	25.000	35.000	ELEVTR	BDFLAP	.000	RN/L	SREF	50.FT.
○					.000		LREF	INCHES
□					.000		BREF	INCHES
					.000		XMRP	INCHES
					-11.700	MACH	YMRP	INCHES
							ZMRP	INCHES
							SCALE	.0100

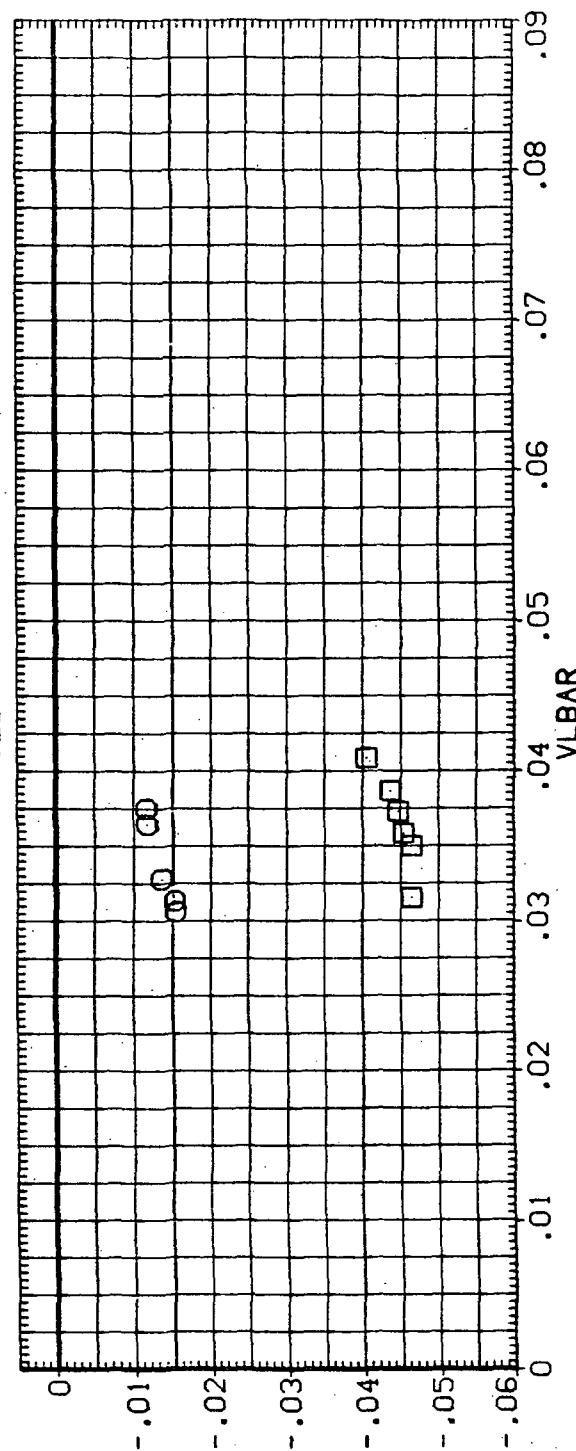
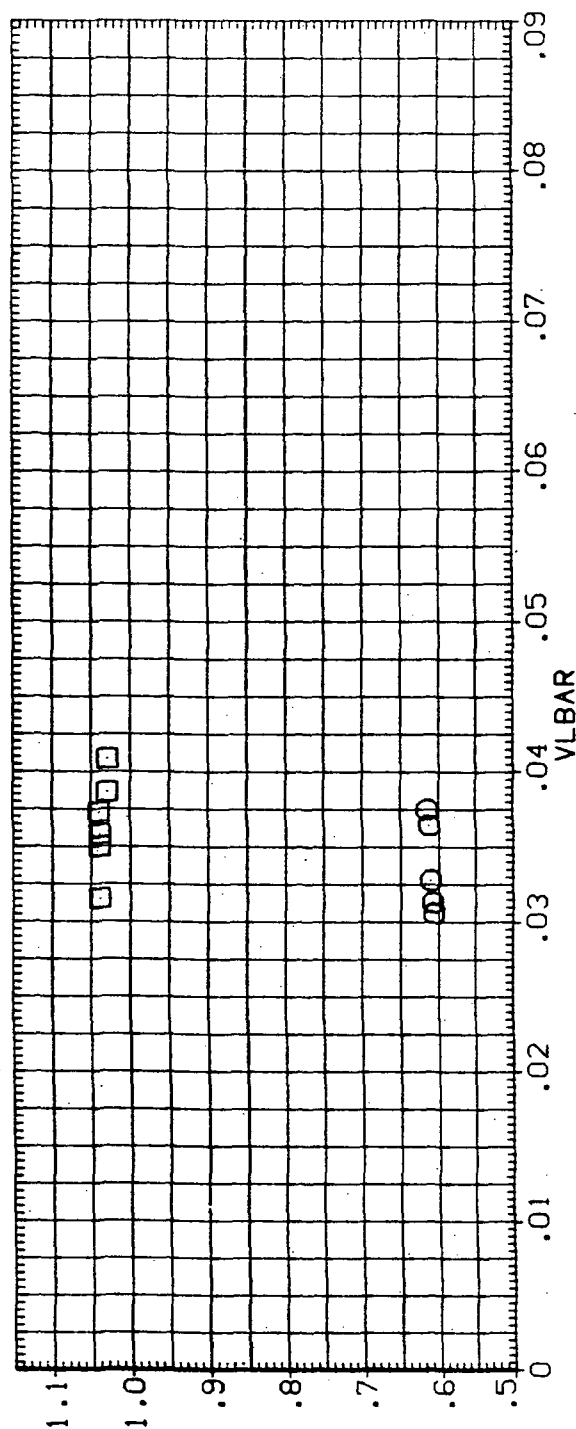


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC489(0A81) B26C9F7M7N28 W116E26 V8R5 INVERTED(FT0015)

SYMBOL
□

ALPHA
25.000
35.000

BETA
ELEVTR
RUDDER
BDFLAP

PARAMETRIC VALUES
.000 RN/L
.000 AILRON
.000 SPDBRK
-11.700 MACH

.250
.000
55.000
20.000

REFERENCE INFORMATION
SREF 2690.0000 SQ.FT.
LREF 474.8000 INCHES
BREF 936.7000 INCHES
XHRP 1076.7000 INCHES
YMRP 375.0000 INCHES
ZMRP 375.0000 INCHES
SCALE .0100

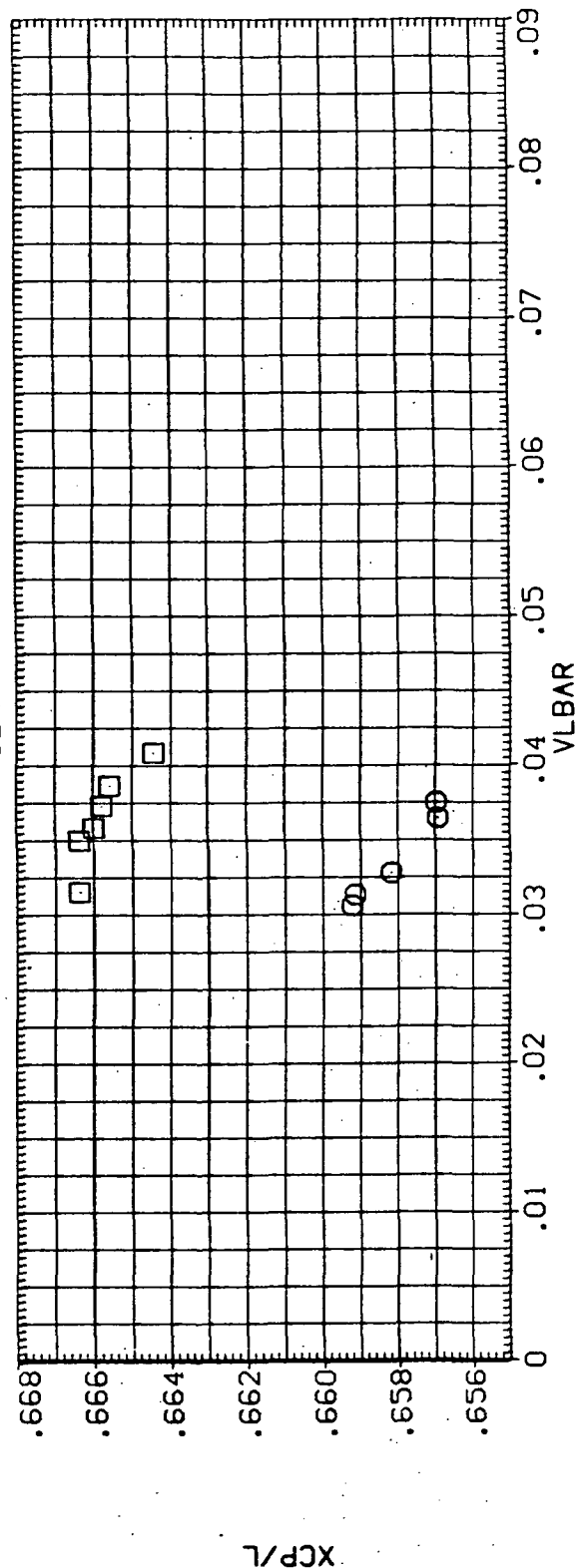
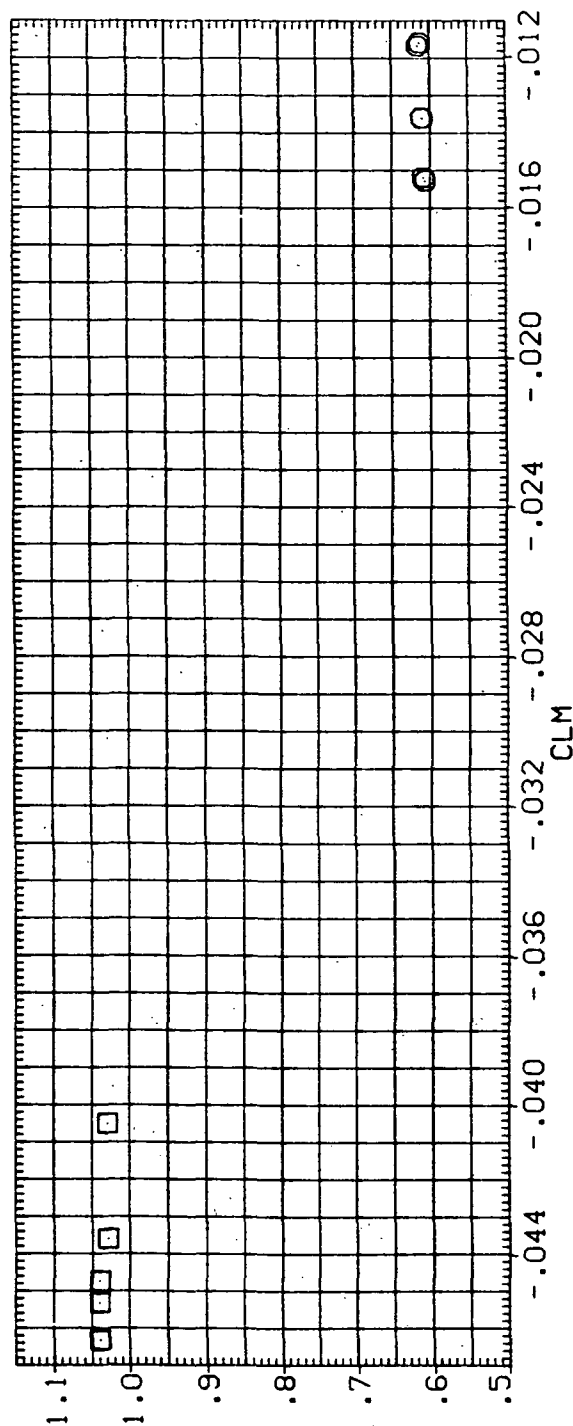


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	ELEVTR	RN/L	SREF	2690.0000	SQ.FT.	
○	25.000	.000	.000	.250	LREF	474.8000	INCHES	
□	35.000	.000	.000	.000	BREF	936.7000	INCHES	
		.000	.000	55.000	XMRP	1076.7000	INCHES	
		-11.700		MACH	YMRP	375.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

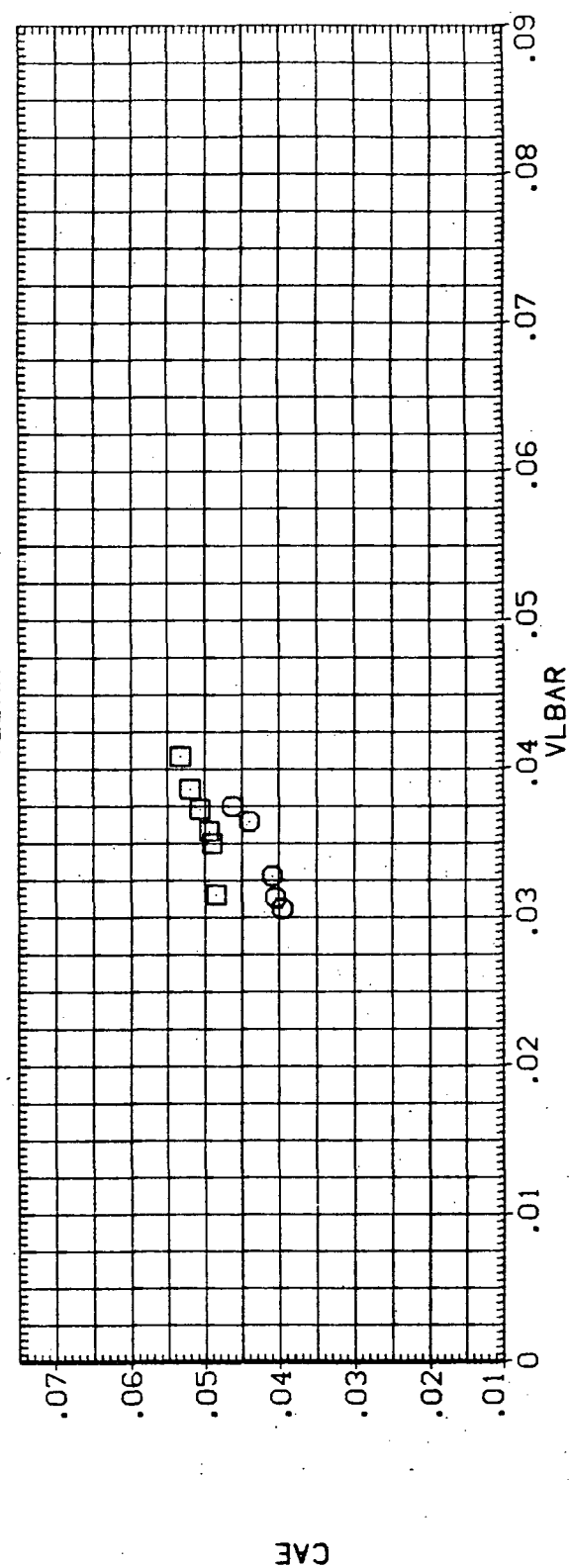
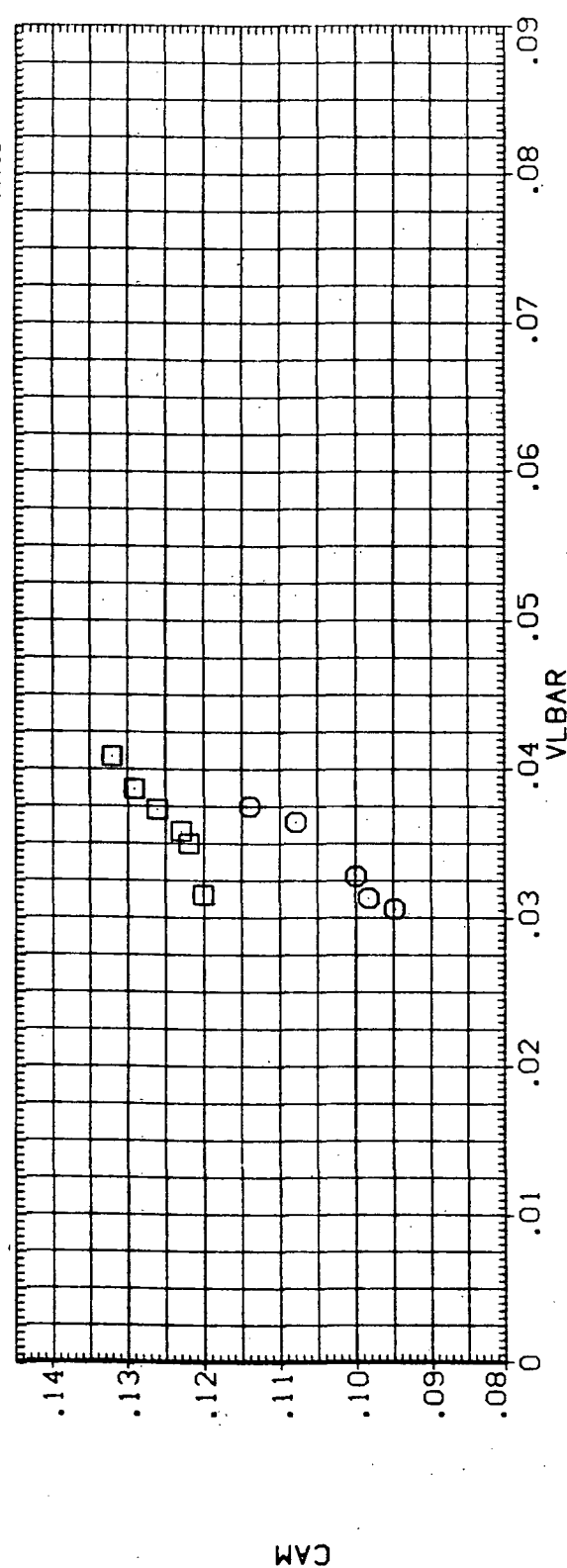


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC489(0A81) B26C9F7M7N28 W116E26 V8R5 INVERTED(FT0015)

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	.000	RN/L	SREF	2690.0000	50.FT.	
○	25.000	ELEVTR	.000	AILRON	LREF	474.8000	INCHES	
□	35.000	RUDDER	.000	SPOBRK	BREF	936.7000	INCHES	
					XMRP	1076.7000	INCHES	
		BOFLAP	-11.700	MACH	YMRP	.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

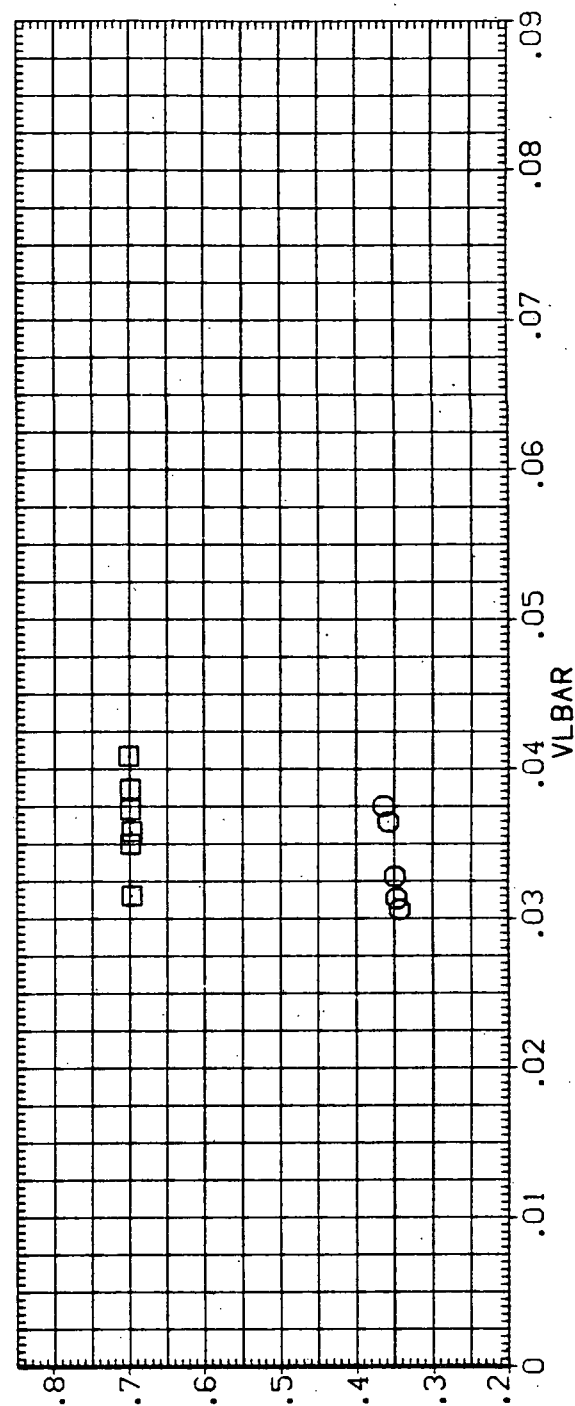
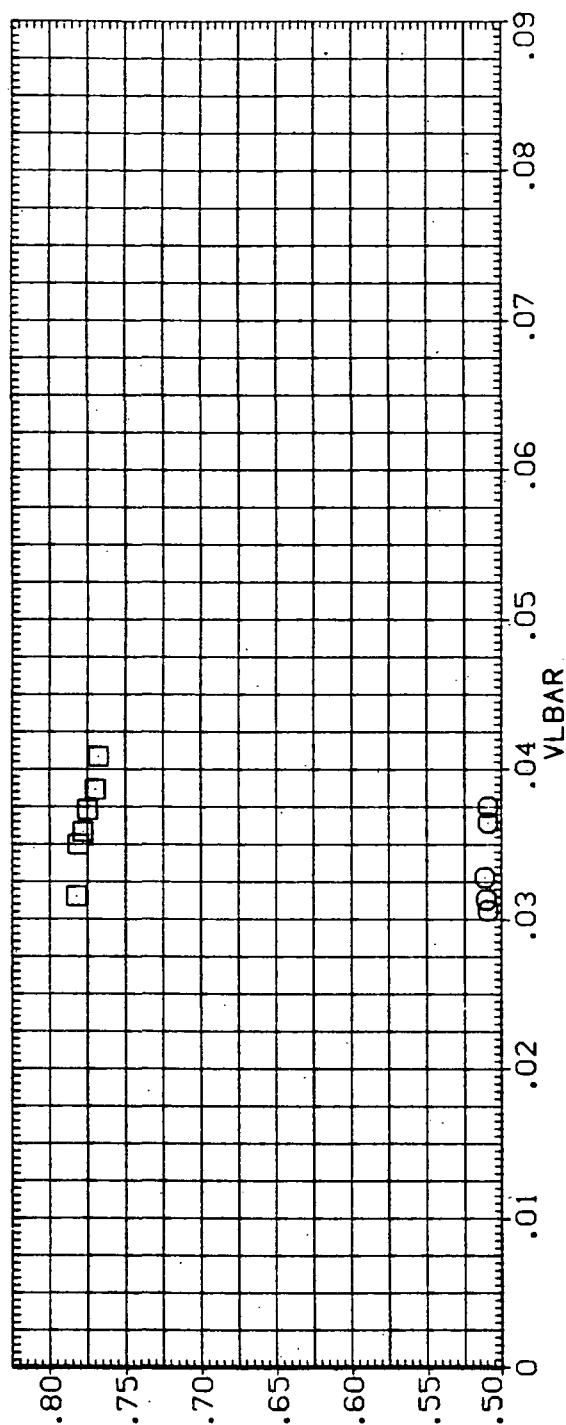


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	ALPHA	PARAMETRIC VALUES				REFERENCE INFORMATION			
		BETA	.000	RN/L	.500	SREF	2690.0000	50.FT.	INCHES
O	35.000	ELEVTR	.000	AILRON	.000	LREF	474.8000	INCHES	
		RUDDER	.000	SPDBRK	55.000	BREF	936.7000	INCHES	
		BDFLAP	-11.700	MACH	16.000	XMRP	1076.7000	INCHES	
						YMRP	.0000	INCHES	
						ZMRP	375.0000	INCHES	
					SCALE	.0100			

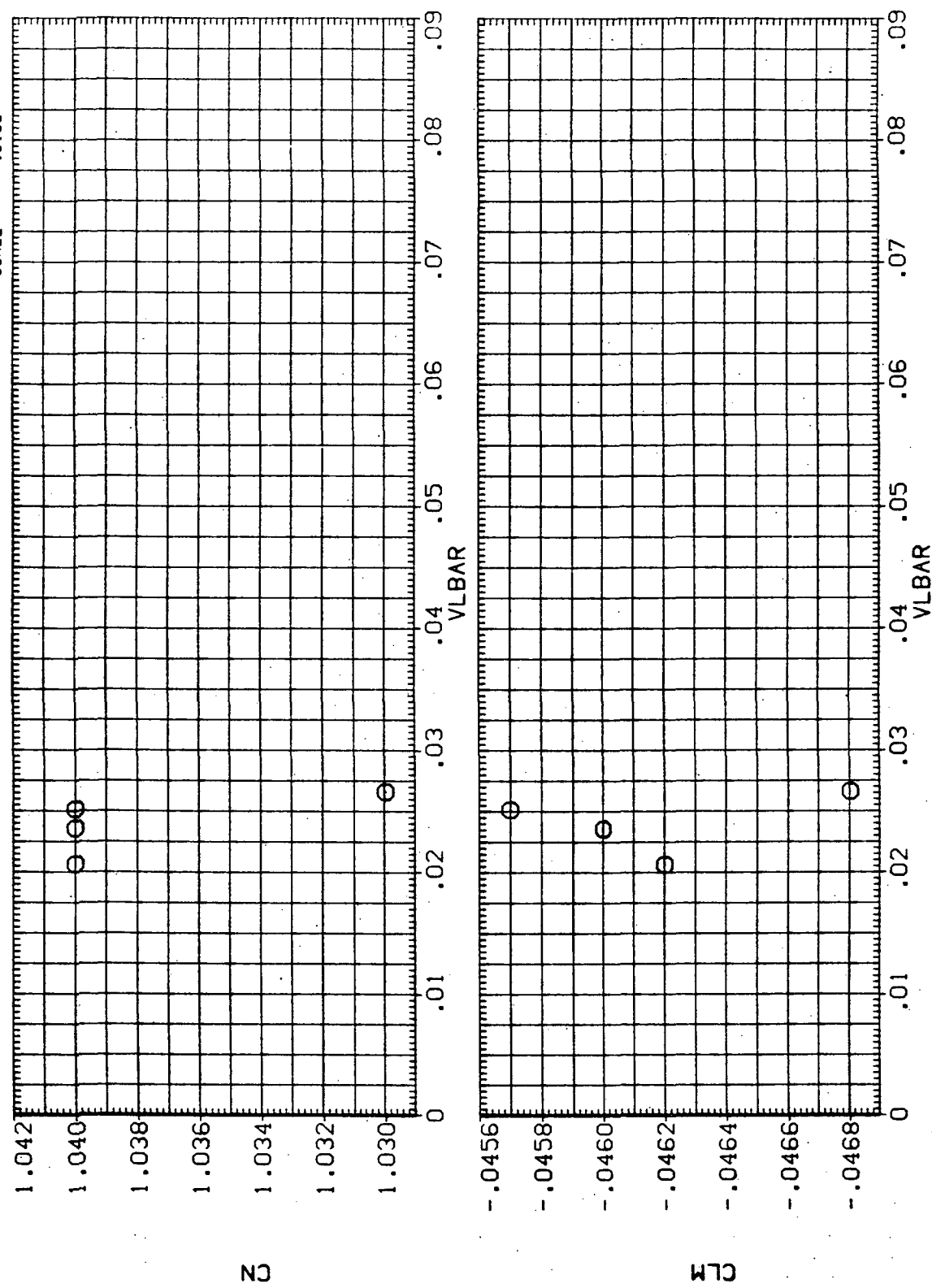


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

AEDC489(0A81) B26C9F7M7N28 W116E26 V8R5 INVERTED(FT0016)

REFERENCE INFORMATION	
SREF	2690.0000
LREF	474.8000
BREF	936.7000
XHRP	1076.7000
YHRP	.0000
ZHRP	375.0000
SCALE	.0100

PARAMETRIC VALUES			
BETA	.000	RN/L	.500
ELEVTR	.000	AILRON	.000
RUDDER	.000	SPDBRK	55.000
BDFLAP	-11.700	MACH	16.000

SYMBOL ALPHA 35.000

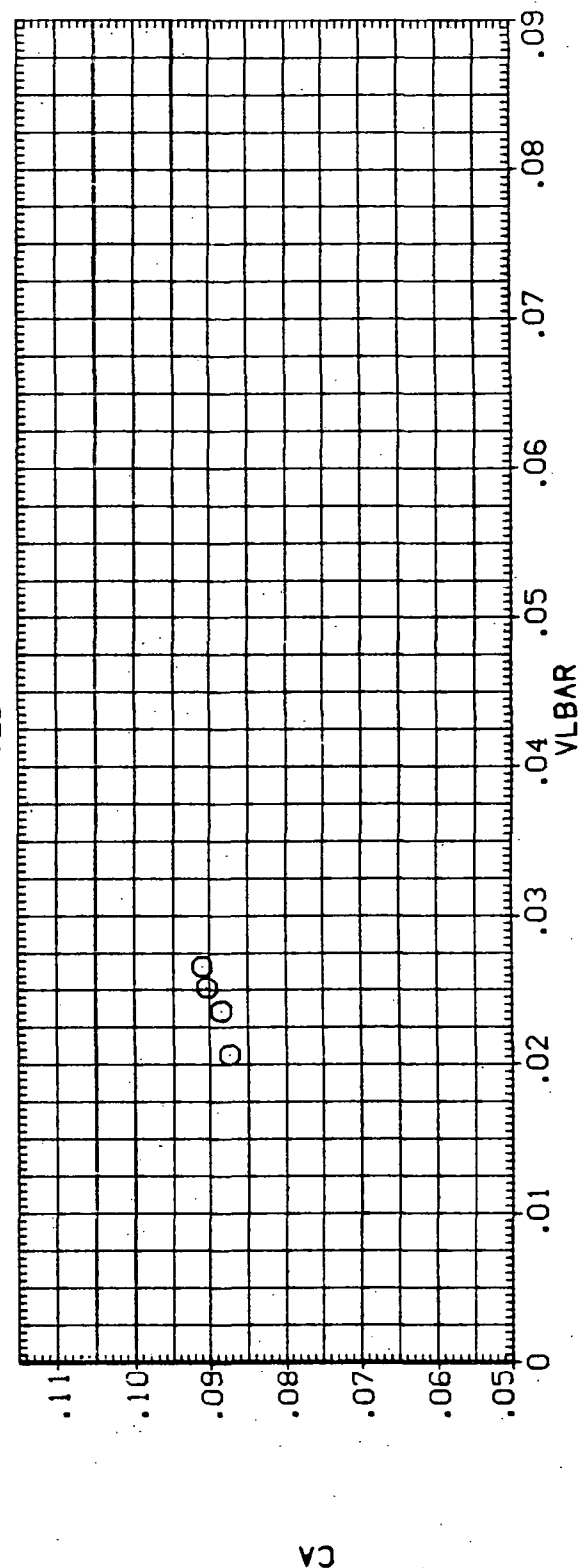
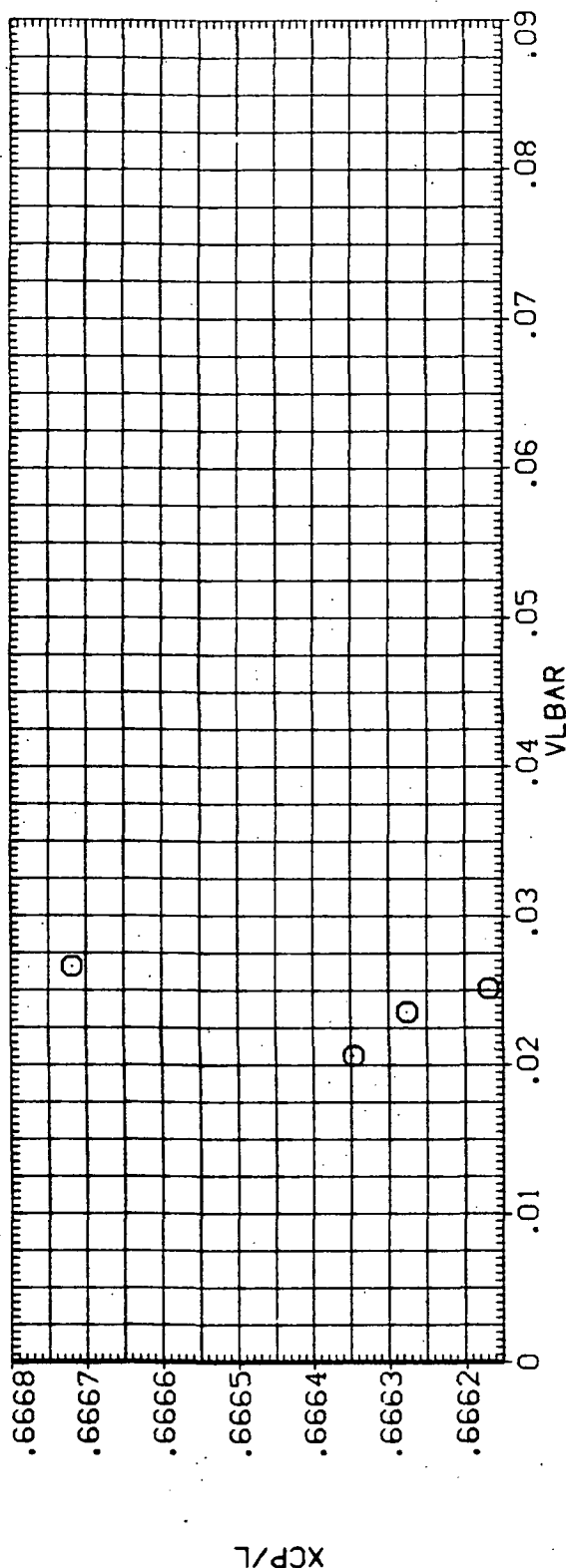


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

SYMBOL	PARAMETRIC VALUES				REFERENCE INFORMATION			
	ALPHA	BETA	.000	RN/L	SREF	2690.0000	50.FT.	
O	35.000	ELEVTR	.000	AILRON	LREF	474.8000	INCHES	
		RUDDER	.000	SPOBRK	BREF	936.7000	INCHES	
		BOFLAP	-11.700	MACH	XMRP	1076.7000	INCHES	
					YMRP	.0000	INCHES	
					ZMRP	375.0000	INCHES	
					SCALE	.0100		

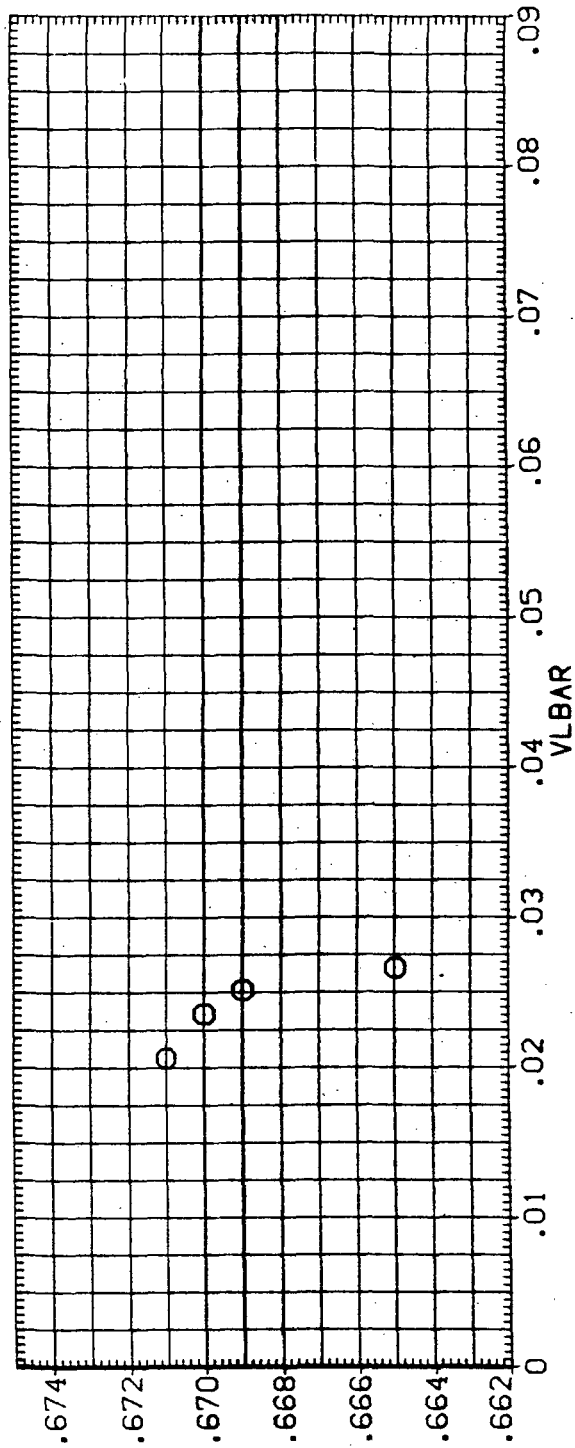
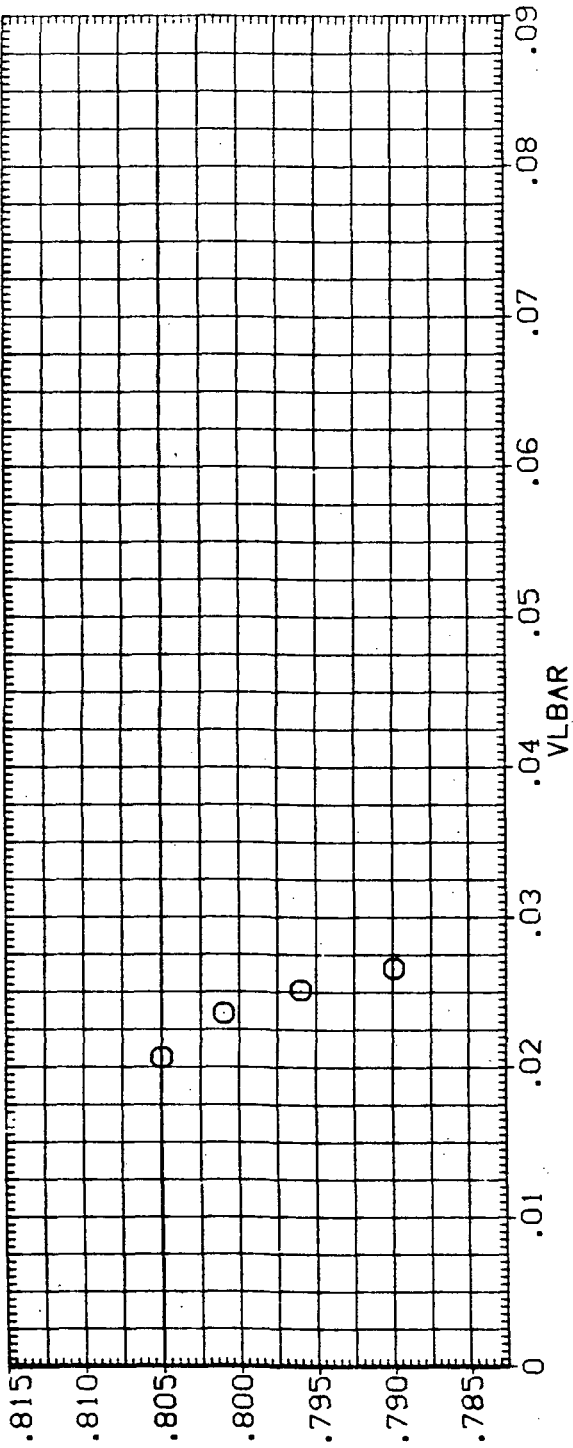


FIGURE 5. HYPERSONIC CHARACTERISTICS OF SPACE SHUTTLE ORBITER 140 A/B

APPENDIX
TABULATED SOURCE DATA

AEDC VA489(OA-01), (B26C9F7M7N28)(W116E26)(V8R5)

(RT0001) (04 NOV 75)

• REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	1
ELEVTR	1
RUDDER	1
BDEF AP	1

PARAMETRIC DATA

MACH	ALPHA	TIME	RUN NO.	4 / 0	RN/L =	.87	GRADIENT INTERVAL =	-5.00/	L/D
			CN		CLM	XCP/L	CL	CD	
6.000	20.000	60.00000	.35600		.01510	.63439	.31100	.18600	1.67000
5.700	20.000	65.00000	.36000		.01400	.63569	.31400	.18900	1.67000
5.700	20.000	70.00000	.36400		.01290	.63696	.31700	.19200	1.65000
5.400	20.000	80.00000	.37000		.01080	.63926	.32200	.19700	1.64000
5.000	20.000	100.00000	.38000		.00700	.64333	.33600	.20500	1.64000
	GRADIENT	.00000	.00000		.00000	.00000	.00000	.00000	.00000

CA	C AF	VLBAR
.06900	.06870	.01264
.07000	.06970	.01364
.07200	.07170	.01489
.07500	.07470	.01489
.07800	.07770	.01477
.08000	.08000	.00000

MACH	ALPHA	TIME	RUN NO.	3/ 0	RN/L =	1.02	GRADIENT INTERVAL =	-5.00/	5.00	L/D
6.400	25.000	70.00000		CN	.02290	.63304	.42200	.27300	1.550000	
6.400	25.000	75.00000			.02030	.63491	.42000	.27200	1.540000	
6.400	25.000	80.00000			.01710	.63718	.41500	.27000	1.540000	
6.000	25.000	90.00000			.01530	.63849	.41300	.27200	1.520000	
5.600	25.000	100.00000			.01690	.63744	.41700	.27700	1.500000	
	GRADIENT	.00000			.00000	.00000	.00000	.00000	.000000	

CA	CAP	VLBAR
.06900	.06900	.01314
.06900	.06900	.01301
.06950	.06950	.01325
.07180	.07180	.01431
.07500	.07500	.01631
.00000	.00000	.00000

MACH	ALPHA	TIME	RUN NO.	2/ 0	RN/L =	.97	GRADIENT	INTERVAL =	-5.00/	5.00	L/D
6.000	30.000	60.00000		CN	CLM	XCP/L	CL	CD			1.380000
5.900	30.000	70.00000		.75200	.03160	.63454	.61200	.44400			1.370000
5.800	30.000	80.00000		.75900	.03450	.63327	.61700	.45000			1.360000
5.700	30.000	90.00000		.76300	.03530	.63298	.61900	.45500			1.350000
5.600	30.000	100.00000		.77000	.03690	.63237	.62300	.46000			1.340000
5.500	30.000			.77600	.03650	.63269	.62800	.46400			1.350000
	GRADIENT			.00000	.00000	.00000	.00000	.00000			.00000

CA	CAF	VLBAR
.07800	.07820	.01227
.08100	.08130	.01374
.08400	.08430	.01452
.08600	.08640	.01526
.08800	.08840	.01558
.09000	.09000	.00000

MACH	ALPHA	TIME	RUN NO.	1 / 0	RN/L =	XCP/L	CL	CD	L/D
6.100	35.000	60.00000			.94	.63590	.77800	.65300	1.19000
5.700	35.000	65.00000				.63609	.77200	.64900	1.19000
5.600	35.000	70.00000				.63606	.76500	.64500	1.19000
5.600	35.000	80.00000				.63669	.75100	.63500	1.18000
5.500	35.000	90.00000				.63577	.74300	.63000	1.18000
	GRADIENT	.00000				.00000	.00000	.00000	.00000

CA	CAF	VLBAR
.08800	.08860	.01223
.08830	.08890	.01304
.08880	.08940	.01417
.08900	.08950	.01520
.09000	.09050	.01520
.09000	.09000	.00000

AEDC VA489(OA-81), (B26C9F7M7N28)(W16E26)(V8R5)

(5T0001) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	=	RN/L	=	1.100
ELEVTR	=	-40.000	=	AILRON	=	.000
RUDDER	=	.000	=	SPDBRK	=	55.000
BDFLAP	=	-11.700				

MACH	ALPHA	TIME	PO	P	Q(PST)	TO	GRADIENT INTERVAL	RN/L	RE-L	CPB	V-INF	VLBAR
15.000	20.000	50.000000	1637.00000	.00998	1.87000	4041.00000	-5.00/	5.00	1.05000	-.00180	.01450	.01284
15.700	20.000	65.000000	1035.00000	.01010	1.74000	4303.00000			.88000	-.00180	.01570	.01364
15.700	20.000	70.000000	10470.00000	.00917	1.65000	4650.00000			.72000	-.00178	.01439	.01499
15.400	20.000	80.000000	9500.00000	.00958	1.58000	4655.00000			.69000	-.00175	.01720	.01489
15.000	20.000	100.000000	7771.00000	.00973	1.45000	4204.00000			.69000	-.00169	.01680	.01477
	GRADIENT	.00000	.00000	.00000	.00000	.00000			.00000	.00000	.00000	.00000

MACH	ALPHA	TIME	PO	P	Q(Psi)	TO	GRADIENT INTERVAL	=	-5.00/	5.00	RE-L	CPB	V-INF	VLBAR
16.400	25.000	70.00000	10374.00000	.00796	1.46000	3599.00000					1.09000	-.00022	.01470	.01314
16.400	25.000	75.00000	10003.00000	.00765	1.43000	3526.00000					1.12000	-.00023	.01450	.01301
16.400	25.000	80.00000	9557.00000	.00746	1.41000	3357.00000					1.09000	-.00025	.01470	.01325
16.000	25.000	90.00000	8739.00000	.00734	1.34000	3660.00000					.86000	-.00025	.01610	.01431
15.600	25.000	100.00000	7984.00000	.00740	1.23000	4433.00000					.60000	-.00026	.01870	.01631
	GRADIENT	.00000	.00000	.00000	.00000	.00000					.00000	.00000	.00000	.00000

MACH	ALPHA	TIME	PO	P	Q(PSI)	TO	GRADIENT INTERVAL	=	-5.00/	5.00	CPB	V-INF	VLBAR
16.000	30.000	60.000000	1321.00000	.01010	1.80000	3710.00000			1.18000		.00160	.01370	.01227
15.900	30.000	70.000000	10185.00000	.00861	1.52000	4160.00000			.90000		.00187	.01560	.01374
15.100	30.000	80.00000	9293.00000	.00729	1.32000	4106.00000			.83000		.00215	.01650	.01452
16.400	30.000	90.00000	8550.00000	.00646	1.20000	3460.00000			.82000		.00243	.01690	.01526
16.400	30.000	100.00000	7806.00000	.00579	1.08000	3569.00000			.78000		.00274	.01730	.01558
16.400	GRADIENT	.00000	.00000	.00000	.00000	.00000			.00000		.00000	.00000	.00000

MACH	ALPHA	TIME	PO	P	Q (PSI)	TO	GRADIENT INTERVAL =	RN/L =	1 / 0	-5.00 /	5.00	RE-L	CPB	V-INF	VLBAR
16.100	35.000	60.000000	1397.00000	.00963	1.80000	3744.00000						1.20000	.00390	.01370	.01223
15.700	35.000	65.000000	10666.00000	.01030	1.75000	4036.00000						.98000	.00370	.01480	.01304
15.600	35.000	70.000000	10211.00000	.00968	1.68000	4391.00000						.80000	.00358	.01630	.01417
15.600	35.000	80.000000	9273.00000	.00870	1.53000	4481.00000						.69000	.00340	.01750	.01520
15.500	35.000	90.000000	8473.00000	.00842	1.39000	4314.00000						.69000	.00330	.01740	.01520
	GRADIENT	.00000	.00000	.00000	.00000	.00000						.00000	.00000	.00000	.00000

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(V8R5)

(RT0002) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1075.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	935.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	==
ELEVTR	==
RUDDER	==
BDFLAP	==

	RN/L	=	.000
	AIRON	=	-40.000
	SPDBRK	=	.000
			-11.700
			.250
			.000
			55.000

PARAMETRIC DATA

MACH	ALPHA	TIME	RUN NO.	B/ 0	RN/L =	.24	GRADIENT INTERVAL =	-5.00/	5.00	L/D	CAE	CAM	CAFM
20.300	20.000	60.00000		CN	CLM	XCP/L	CL	CD		1.56000	.03837	.08580	.08631
20.300	20.000	70.00000		.38400	.00869	.64167	.33100	.21200		.21200	.04135	.09200	.09250
20.300	20.000	80.00000		.38400	.00869	.64167	.32900	.21800		1.51000	.03492	.08310	.08360
19.300	20.000	100.00000		.38400	.01080	.63965	.32000	.21000		1.58000	.03848	.09150	.09200
19.100	20.000	120.00000		.38300	.01180	.63972	.32800	.21700		1.51000	.03872	.09480	.09529
19.000	20.000	140.00000		.38200	.01170	.63867	.32500	.21600		1.48000	.03750	.09370	.09417
19.200	20.000	GRADIENT		.38000	.00000	.00000	.00000	.00000		.00000	.00000	.00000	.00000

MACH	ALPHA	TIME	RUN NO.	7 / 0	RN/L =	.25	GRADIENT INTERVAL =	-5.00/	5.00	CD	L/D	CAE	CAM	CAFM
19.900	25.000	90.00000		.52200	.01750	.63766	.43800	.29500			1.49000	.03227	.08200	.08224
19.600	25.000	100.00000		.51800	.01590	.63870	.43200	.29800			1.45000	.03427	.08740	.08764
19.600	25.000	110.00000		.51800	.01590	.63870	.43100	.30100			1.43000	.03536	.09090	.09114
19.500	25.000	120.00000		.51300	.01440	.63967	.42500	.30100			1.41000	.03583	.09280	.09280
19.700	25.000	130.00000		.51100	.01430	.63970	.42400	.30000			1.41000	.03465	.09280	.09243
19.800	25.000	140.00000		.50600	.01150	.64164	.42000	.29800			1.41000	.03393	.09200	.09222
19.600	25.000	150.00000		.50300	.01140	.64166	.41700	.29500			1.41000	.03377	.09220	.09220
GRADIENT				.00000	.00000	.00000	.00000	.00000			.00000	.00000	.00000	.00000

MACH	ALPHA	TIME	RUN NO.	6 / 0	RN/L =	.25	GRADIENT INTERVAL =	-5.00/	5.00	L/D	CAE	CAM	CAFM
19.900	30.000	80.00000		CN	CLM	XCP/L	CL	CD					
19.800	30.000	90.00000		.72500	.02230	.63868	.58300	.44000		1.32000	.03334	.08900	.08981
19.800	30.000	90.00000		.72300	.01640	.64165	.57800	.44500		1.30000	.03619	.09610	.09689
19.800	30.000	100.00000		.70900	.01410	.64268	.56200	.44500		1.26000	.03937	.10470	.10478
19.500	30.000	110.00000		.70200	.01020	.64465	.55700	.44000		1.26000	.03716	.10200	.10276
19.400	30.000	120.00000		.69400	.00816	.64567	.55100	.43300		1.27000	.03431	.09880	.09954
GRADIENT				.00000	.00000	.00000	.00000	.00000		.00000	.00000	.00000	.00000

MACH	ALPHA	TIME	RUN NO.	5/ 0	RN/L =	.23	GRADIENT INTERVAL =	-5.00/	5.00	L/D	CAE	CAM	CAFM
20.200	35.000	90.00000								.14000	.04294	.10000	.10129
19.900	35.000	100.00000			.02800	.63865	.68600	.60400		.13000	.04551	.10525	
19.200	35.000	110.00000			.02550	.63965	.68300	.60600		.13000	.04551	.10525	
18.800	35.000	120.00000			.02290	.64068	.67200	.61600		.109000	.05179	.11700	.11823
18.000	35.000	140.00000			.02540	.63965	.67500	.61000		.111000	.04717	.11000	.11219
18.900	35.000	140.00000			.02510	.63968	.66800	.60700		.110000	.04743	.11300	.11414
18.800	35.000	150.00000			.02730	.63867	.66000	.60400		.109000	.04747	.11400	.11509
	GRADIENT	.00000			.00000	.00000	.00000	.00000		.00000	.00000	.00000	.00000

AE DC VA489(0A-81), (826C9F7M7N28) (W116E26) (V8R5)

(ST0002) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA
ELEVTR
RUDDER
BDFLAP

	RN/L	-	.250
	AIRLON	-	.000
	SPOBRK	-	55.000
			-11.700

PARAMETRIC DATA

RUN NO.	8/ 0	'RN/L =	.24	GRADIENT	INTERVAL =	-5.00/	5.00
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MACH	ALPHA	TIME	PO	P	Q(PSI)	TO	RE-L	CPB	V-INF	VLBAR	C-FCIR
20.300	20.000	60.000000	12189.00000	.00185	.54000	4610.00000	.37000	.00330	.03130	.02694	1.22000
20.200	20.000	70.000001	1672.00000	.00176	.53000	4934.00000	.28000	.00325	.03560	.03050	1.21000
19.300	20.000	80.000001	1458.00000	.00198	.51000	6269.00000	.24000	.00325	.03700	.03023	1.36000
19.100	20.000	100.000001	10578.00000	.00185	.48000	6634.00000	.18000	.00320	.04190	.03422	1.36000
19.000	20.000	120.000000	9912.00000	.00175	.44000	6837.00000	.15000	.00315	.04570	.03708	1.43000
19.200	20.000	140.000000	9427.00000	.00154	.40000	6747.00000	.13000	.00300	.04990	.04038	1.48000
19.000	20.000	160.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	180.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	200.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	220.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	240.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	260.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	280.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	300.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	320.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	340.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	360.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	380.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	400.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	420.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	440.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	460.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	480.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	500.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	520.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	540.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	560.000000	9427.00000	.00000	.40000	6747.00000	.13000	.00000	.04990	.04038	1.48000
19.000	20.000	580.000000	9427.00000	.00000	.40000	6747					

RUN NO.	7/ 0	RN/L =	.25	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	6/ 0	RN/L =	.25	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	5/ 0	RN/L =	.23	GRADIENT	INTERVAL =	--5.00/	5.00
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[illegible]

AE DC VA489(OA-81), (B26C9F7M7N28)(W16E25)(V8R5)

(RT0003) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	ALLRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	-11.700			

PARAMETRIC DATA

RUN NO.	11/ 0	RN/L = 1.18	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

RUN NO.	10/ 0	RN/L =	1.03	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	9/ 0	RN/L = 1.01	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(V8R5)

(5T0003) (04 NOV 75)

REFERENCE DATA

SREF = 2690.0000 SQ.FT.
LREF = 474.8000 INCHES
BREF = 936.7000 INCHES
SCALE = .0100

XMRP	=	1076.7000	INCHES
YMRP	=	.0000	INCHES
ZMRP	=	375.0000	INCHES

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	AILRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	-11.700			

PARAMETRIC DATA

RUN NO.	11 / 0	RN/L = 1.18	GRADIENT INTERVAL = -5.00 / 5.00
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[illegible]

RUN NO.	10/ 0	RN/L = 1.03	GRADIENT INTERVAL. = -5.00/ 5.00
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[illegible]

RUN NO.	9/ 0	RN/L =	1.01	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

AEDC VA489(OA-81), (B26C9F7M7N2B) (W116E26) (V8R5)

(RT0004) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	■ ■ ■ ■
ELEVTR	
RUDDER	
BOFLAP	

.000	RN/L	=	1.100
.000	AIRON	=	.000
.000	SPDBRK	=	55.000
.000			

PARAMETRIC DATA

RUN NO.	15/ 0	RN/L =	1.06	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

RUN NO.	14/ 0	RN/L =	1.03	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO. 13/ 0 RN/L = .95 GRADIENT INTERVAL = -5.00/ 5.00

[illegible]

RUN NO.	12/ 0	BN/L = 1.07	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

(ST00004) (04 NOV 75)

REFERENCE DATA

=	SRREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
=	LRREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
=	BRREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
=	SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	ATLRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	.000			

RUN NO.	15/ 0	RN/L =	1.06	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

RUN NO.	14/ 0	RN/L =	1.03	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

RUN NO.	13/ 0	RN/L =	.95	GRADIENT INTERVAL =	-5.00/	5.00
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MACH	ALPHA	TIME	PO	P	Q(PST)	TO	RE-L	CPB	V-INF	VLBAR
16.200	30.000	50.00000012503	0.0000	.01040	1.80000	3624.00000	1.33000	.00273	.01310	.01174
16.100	30.000	55.0000012066	0.0000	.01010	1.90000	4070.00000	1.04000	.00284	.01279	.01279
15.800	30.000	60.0000011662	0.0000	.00943	1.71000	4203.00000	.89000	.00296	.01590	.01395
15.500	30.000	70.0000010475	0.0000	.00888	1.52000	4529.00000	.69000	.00319	.01780	.01538
15.300	30.000	80.0000009519	0.0000	.00801	1.34000	4704.00000	.68000	.00340	.01800	.01572
15.000	30.000	90.0000008680	0.0000	.00713	1.24000	4909.00000	.65000	.00360	.01850	.01623
14.800	30.000	100.0000007890	0.0000	.00626	1.14000	5144.00000	.62000	.00381	.01900	.01678
14.600	30.000	110.0000007140	0.0000	.00540	1.04000	5404.00000	.59000	.00402	.01950	.01733
14.400	30.000	120.0000006420	0.0000	.00454	.94000	5684.00000	.56000	.00423	.02000	.01788
14.200	30.000	130.0000005730	0.0000	.00368	.84000	5984.00000	.53000	.00444	.02050	.01843
14.000	30.000	140.0000005080	0.0000	.00282	.74000	6304.00000	.50000	.00465	.02100	.01898
13.800	30.000	150.0000004470	0.0000	.00196	.64000	6644.00000	.47000	.00486	.02150	.01953
13.600	30.000	160.0000003890	0.0000	.00110	.54000	7004.00000	.44000	.00507	.02200	.02008
13.400	30.000	170.0000003340	0.0000	.00024	.44000	7384.00000	.41000	.00528	.02250	.02063
13.200	30.000	180.0000002820	0.0000	.00000	.34000	7784.00000	.38000	.00549	.02300	.02118
13.000	30.000	190.0000002330	0.0000	.00000	.24000	8204.00000	.35000	.00570	.02350	.02173
12.800	30.000	200.0000001870	0.0000	.00000	.14000	8644.00000	.32000	.00591	.02400	.02228
12.600	30.000	210.0000001440	0.0000	.00000	.04000	9104.00000	.29000	.00612	.02450	.02283
12.400	30.000	220.0000001030	0.0000	.00000	.00000	9584.00000	.26000	.00633	.02500	.02338
12.200	30.000	230.0000000640	0.0000	.00000	.00000	10084.00000	.23000	.00654	.02550	.02393
12.000	30.000	240.0000000270	0.0000	.00000	.00000	10604.00000	.20000	.00675	.02600	.02448
11.800	30.000	250.0000000000	0.0000	.00000	.00000	11144.00000	.17000	.00696	.02650	.02503
11.600	30.000	260.0000000000	0.0000	.00000	.00000	11704.00000	.14000	.00717	.02700	.02558
11.400	30.000	270.0000000000	0.0000	.00000	.00000	12284.00000	.11000	.00738	.02750	.02613
11.200	30.000	280.0000000000	0.0000	.00000	.00000	12884.00000	.08000	.00759	.02800	.02668
11.000	30.000	290.0000000000	0.0000	.00000	.00000	13504.00000	.05000	.00780	.02850	.02723
10.800	30.000	300.0000000000	0.0000	.00000	.00000	14144.00000	.02000	.00801	.02900	.02778
10.600	30.000	310.0000000000	0.0000	.00000	.00000	14804.00000	.00000	.00822	.02950	.02833
10.400	30.000	320.0000000000	0.0000	.00000	.00000	15484.00000	.00000	.00843	.03000	.02888
10.200	30.000	330.0000000000	0.0000	.00000	.00000	16184.00000	.00000	.00864	.03050	

RUN NO.	12/ 0	RN/L =	1.07	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

AEDC VA489(0A-81), (B26C9F7M7N28) (W116E26) (V8R5)

(RT0005) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	<input type="checkbox"/>
ELEVTR	<input type="checkbox"/>
RUDDER	<input type="checkbox"/>
BDFLAP	<input type="checkbox"/>

RN/L	-	.250
AILRON	-	.000
SPDBRK	-	55.000

PARAMETRIC DATA

RUN NO.	19/ 0	RN/L =	.23	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	18/ 0	RN/L =	.22	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	17/ 0	RN/L =	.20	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	16/ 0	RN/L =	.24	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

AEDC VA489(0A-81), (B26C9F7M7N28) (W116E26) (V8R5)

(ST0005) : (04 NOV 75)

REFERENCE DATA

■ SREF	2690.0000	SO. FT.	XMRP	=	1076.7000	INCHES
■ LREF	474.8000	INCHES	YMRP	=	.0000	INCHES
■ BREF	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100				

BETA	==
ELEVTR	==
RUDDER	==
BOFLAP	==

RN/L	=	.250
AILRON	=	.000
SPDBRK	=	55.000

PARAMETRIC DATA

RUN NO.	19/ 0	RN/L =	.23	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

RUN NO.	18/ 0	RN/L =	.22	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	17/ 0	RN/L =	.20	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	16/ 0	RN/L =	.24	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA, AEDC VA 489, OAB1

PAGE 11

AEDC VA489(OA-81), (B26C9F7M7N2B)(W116E26)(V8R5)

REFERENCE DATA

SREF = 2690.0000 SO.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 48/ 0 RN/L = .20 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CAE	CAM	CAF
20.200	25.000	80.00000	.62300	-.01350	.65797	.52500	.34900	1.50000	.03565	.09370	.09433
20.400	25.000	90.00000	.61600	-.01230	.65735	.51700	.34700	1.49000	.03630	.09530	.09588
19.400	25.000	100.00000	.60500	-.01180	.65718	.50700	.34500	1.47000	.03713	.09740	.09794
19.400	25.000	110.00000	.59700	-.01130	.65697	.49900	.34300	1.45000	.03815	.10000	.10051
19.900	25.000	120.00000	.58800	-.01030	.65645	.48900	.34200	1.43000	.03931	.10300	.10350
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = .250
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

RUN NO. 21/ 0 RN/L = .24 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CAE	CAM	CAF
19.900	35.000	90.00000	.98000	-.03720	.66397	.74400	.64500	1.15000	.04368	.10000	.10137
20.300	35.000	100.00000	.99400	-.03770	.66396	.75100	.65000	1.14000	.04724	.10800	.10937
20.100	35.000	110.00000	1.00000	-.03740	.66376	.75300	.65900	1.13000	.04991	.11400	.11537
19.700	35.000	120.00000	.99800	-.03360	.66239	.74900	.67000	1.12000	.05168	.11800	.11937
18.300	35.000	130.00000	.98800	-.03080	.66147	.74000	.68500	1.11000	.05257	.12000	.12137
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

REFERENCE DATA

SREF = 2690.0000 SO.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 48/ 0 RN/L = .20 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	PO	P	Q(PS1)	TO	RE-L	CPB	V-INF	VLBAR	C-FCTR
20.200	25.000	80.00000	1196.00000	.00153	.44000	5554.00000	.23000	.00405	.03890	.03304	1.60000
20.400	25.000	90.00000	10826.00000	.00145	.42000	5254.00000	.20000	.00375	.04230	.03610	1.60000
19.400	25.000	100.00000	10583.00000	.00156	.42000	5642.00000	.18000	.00350	.04300	.03475	1.60000
19.400	25.000	110.00000	10221.00000	.00156	.41000	7082.00000	.16000	.00330	.04540	.03639	1.60000
19.900	25.000	120.00000	9911.00000	.00146	.40000	5849.00000	.14000	.00325	.04910	.04134	1.60000
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = .250
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

AEDC VA489(OA-81), (B26C9F7M7N2B)(W116E26)(V8R5)

AEDC VA489(OA-81), (B26C9F7M7N28) (W116E26) (V8R5)

(ST0006) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.250
ELEVTR	=	.000	AIRON	=	.000
RUDDER	=	.000	SPDRK	=	55.000
BDFLAP	=	.000			

RUN NO.	21/ 0	RN/L =	.24	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)

(RT0007) (04 NOV 75)

REFERENCE DATA

XSREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LRREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BRREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.500
ELEVTR	=	.000	ATLRON	=	.000
RUDDER	=	.000	SPDRK	=	55.000
BDFLAP	=	.000			

RUN NO.	25/ 0	RN/L =	.39	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	24/ 0	RN/L =	.45	GRADIENT INTERVAL =	-5.00/	5.00

[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA, AEDC VA 489, OA81

PAGE 13

AEDC VA489(OA-81), (B26C9F7M/N28)(W116E2S)(VBR5)

(RT0007) (04 NOV 75)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 RN/L = .500
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

RUN NO. 23/ 0 RN/L = .48 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CA	CAF	VLBAR
15.500	30.000	55.00000	.79900	-.02800	.66290	.65000	.47100	1.38000	.08230	.08230	.01660
15.600	30.000	60.00000	.80700	-.02460	.66122	.65600	.47800	1.37000	.08540	.08540	.01876
15.900	30.000	80.00000	.82400	-.02290	.66023	.66700	.49200	1.35000	.09280	.09280	.02185
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

RUN NO. 22/ 0 RN/L = .44 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CA	CAF	VLBAR
15.900	35.000	55.00000	.96700	-.05310	.67021	.74700	.61900	1.21000	.07800	.07890	.01682
15.800	35.000	60.00000	.98300	-.04860	.66819	.75700	.63200	1.20000	.08230	.08320	.01854
15.800	35.000	70.00000	1.00000	-.04280	.66575	.77000	.64700	1.19000	.08750	.08840	.02095
15.800	35.000	80.00000	1.02000	-.03890	.66403	.78200	.66100	1.18000	.09170	.09260	.02143
16.000	35.000	90.00000	1.03000	-.03670	.66311	.79100	.67100	1.18000	.09490	.09580	.02174
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 RN/L = .500
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

RUN NO. 25/ 0 RN/L = .39 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	PO	P	Q(PSI)	TO	RE-L	CPB	V-INF	VLBAR
15.400	20.000	55.00000	5908.00000	.00588	.95000	3940.00000	.57000	-.00066	.01910	.01688
15.400	20.000	60.00000	5744.00000	.00530	.89000	4500.00000	.42000	-.00067	.02230	.01927
15.600	20.000	70.00000	5144.00000	.00442	.75000	4675.00000	.33000	-.00065	.02510	.02185
15.700	20.000	80.00000	4681.00000	.00373	.67000	4507.00000	.31000	-.00059	.02630	.02286
15.600	20.000	90.00000	4219.00000	.00362	.62000	4486.00000	.30000	-.00051	.02660	.02310
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

AEDC VA489(OA-81), (B26C9F7M/N28)(W116E26)(VBR5)

(ST0007) (04 NOV 75)

AEDC VA489(OA-81), (B26C9F7M7N28) (W116E26) (V8R5)

(ST0007) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.500
ELEVTR	=	.000	AILRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	.000			

RUN NO.	24/ 0	RN/L =	.45	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	23/ 0	RN/L =	.48	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	22/ 0	RN/L =	.44	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA. AEDC VA 499, OA81

PAGE 15

AE DC VA489(OA-81), (B26C9F7M7N28)(W16E26)(V8R5)

(RT0008) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0000					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.070
ELEVTR	=	.000	ATLRON	=	.000
RUDDER	=	.000	SPDRBK	=	55.000
BDFLAP	=	.000			

RUN NO.	29/ 0	RN/L =	.11	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	28/ 0	RN/L =	.09	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	27/ 0	RN/L =	.08	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	26/ 0	RN/L = .	.09	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

AEDC VA489(0A-81), (B26C9F7M7N2B) (W116E26) (V8R5)

(ST0008) (04 NOV 75)

REFERENCE DATA

SREF	=	2630.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA
ELEVTR
RUDDER
BDFLAP

.000	RN/L	=	.070
.000	ALRON	=	.000
.000	SPDBRK	=	55.000
.000			

PARAMETRIC DATA

RUN NO.	29/ 0	RN/L =	.11	GRADIENT INTERVAL =	-5.00/	5.00

[illegible]

RUN NO.	28/ 0	RN/L =	.09	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	27/ 0	RN/L =	.08	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	26/ 0	RN/L =	.09	GRADIENT INTERVAL	=	-5.00/	5.00
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[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA, AEDC VA 489, OA81

PAGE 17

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(V8R5) (RT0009) (04 NOV 75)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 30/ 0 RN/L = .36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CA	CAF	VLBAR
15.900	35.000	70.00000	.95700	-.06350	.67442	.73700	.61600	1.20000	.08120	.08240	.01929
15.900	35.000	80.00000	.96200	-.06610	.67528	.73900	.62200	1.19000	.08490	.08610	.02178
16.000	35.000	90.00000	.96300	-.06750	.67579	.73800	.62500	1.18000	.08750	.08870	.02316
16.100	35.000	100.00000	.96400	-.06900	.67634	.73800	.62800	1.18000	.08960	.09080	.02417
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = .500
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(V8R5)

(STO009) (04 NOV 75)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 30/ 0 RN/L = .36 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	PO	P	Q(PS1)	TO	RE-L	CPB	V-INF	VLBAR
15.900	35.000	70.00000	5381.00000	.00436	.75000	4068.00000	.46000	.00745	.02180	.01929
15.900	35.000	80.00000	4872.00000	.00382	.67000	4131.00000	.36000	.00759	.02470	.02178
16.000	35.000	90.00000	4410.00000	.00323	.60000	4250.00000	.32000	.00770	.02630	.02316
16.100	35.000	100.00000	4028.00000	.00289	.53000	4127.00000	.30000	.00784	.02740	.02417
	GRADIENT	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = .500
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(VBR5)

(RT0010)

(04 NOV 75)

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 RN/L = .070
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

RUN NO. 49/ 0 RN/L = .11 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CAE	CAM	CAFM
19.000	30.000	80.00000	.81600	-.01170	.65528	.64500	.51400	1.26000	.05380	.12100	.12228
19.200	30.000	90.00000	.81600	-.01170	.65528	.64600	.51300	1.26000	.05311	.12000	.12128
19.300	30.000	100.00000	.81600	-.01170	.65528	.64500	.51500	1.25000	.05400	.12200	.12328
19.000	30.000	110.00000	.81100	-.01470	.65667	.64100	.51200	1.25000	.05331	.12100	.12228
19.500	30.000	120.00000	.80900	-.01640	.65746	.63900	.51000	1.25000	.05331	.12100	.12228
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

RUN NO. 31/ 0 RN/L = .10 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CAE	CAM	CAFM
20.000	35.000	80.00000	1.04000	-.03490	.66235	.77300	.70700	1.09000	.05795	.13400	.13546
19.700	35.000	90.00000	1.03000	-.03420	.66222	.76600	.70700	1.08000	.06015	.13900	.14046
19.500	35.000	100.00000	1.03000	-.03520	.66258	.76100	.70800	1.08000	.06143	.14200	.14347
19.500	35.000	110.00000	1.02000	-.03560	.66284	.75500	.70800	1.07000	.06276	.14500	.14619
19.500	35.000	120.00000	1.02000	-.03620	.66378	.74900	.70800	1.06000	.06450	.14900	.15051
19.400	35.000	130.00000	1.02000	-.03820	.66414	.74500	.71000	1.05000	.06624	.15300	.15454
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

REFERENCE DATA

SREF = 2690.0000 SQ.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

PARAMETRIC DATA

BETA = .000 RN/L = .070
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = .000

RUN NO. 49/ 0 RN/L = .11 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	PO	P	Q(PSI)	TO	RE-L	CPB	V-INF	VLBAR	C-FCTR
19.000	30.000	80.00000	3740.00000	.00075	.19000	5169.00000	.13000	.00825	.04970	.04193	1.22000
19.200	30.000	90.00000	3598.00000	.00072	.19000	4724.00000	.11000	.00825	.05320	.04670	1.23000
19.300	30.000	100.00000	3363.00000	.00059	.18000	5443.00000	.10000	.00825	.05620	.04814	1.23000
19.000	30.000	110.00000	3206.00000	.00064	.17000	5272.00000	.10000	.00825	.05690	.04764	1.24000
19.500	30.000	120.00000	3048.00000	.00054	.17000	4786.00000	.09000	.00825	.06190	.05236	1.24000
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(VBR5)

(ST0010)

(04 NOV 75)

AE DC VA489(OA-81), (B26C9F7M7N28) (W116E26) (V8R5)

(5T0010) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	==
ELEVTR	==
RUDDER	==
BDFLAP	==

PARAMETRIC DATA

RUN NO.	31/ 0	RN/L = .10	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

AE DC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)

(RT0011) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	□
ELEVTR	□
RUDDER	□
BDFLAP	□

PARAMETRIC DATA

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RUN NO.      34/ 0      RN/L = 1.22      GRADIENT INTERVAL = -5.00/ 5.00

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[illegible]

RUN NO.:	33/ 0	RN/L =	1.07	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

AEDC VA489(OA-81), (B26C9F7M7N28) (W116E26) (V8R5)

(RT0011) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	AILRON	=	.00
RUDDER	=	.000	SPOBRK	=	5. J00
BDFLAP	=	16.300			

RUN NO.	32/ 0	RN/L = 1.11	GRADIENT INTERVAL =	-5.00/ 5.00.
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[illegible]

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)

(ST0011) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	50. FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	ATLRON	=	.000
RUDDER	=	.000	SPDRBK	=	55.000
BDFLAP	=	16.300			

RUN NO.	34/ 0	RN/L =	1.22	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	33/ 0	RN/L =	1.07	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA, AEDC VA 489, OAB1

PAGE 21

(ST0011) (04 NOV 75)

AEDC VA489(0A-81), (B26C9F7M7N28)(M116E26)(VBR5)

REFERENCE DATA

SREF = 2690.0000 50.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 32/ 0 RN/L = 1.11 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	PO	P	Q(FS1)	TO	RE-L	CPB	V-INF	VLBAR
16.000	35.000	50.00000	12680.00000	.01150	2.05000	3689.00000	1.37000	.00580	.01280	.01139
15.900	35.000	55.00000	12123.00000	.01070	1.87000	4086.00000	1.11000	.00588	.01410	.01239
16.100	35.000	60.00000	11771.00000	.00941	1.70000	4194.00000	.96000	.00590	.01530	.01344
16.400	35.000	70.00000	10451.00000	.00790	1.50000	3690.00000	.92000	.00600	.01590	.01426
16.500	35.000	80.00000	9601.00000	.00700	1.30000	3494.00000	.95000	.00610	.01580	.01424
16.300	35.000	90.00000	8722.00000	.00675	1.24000	3720.00000	.87000	.00620	.01630	.01456
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = 1.100
 ELEVTR = .000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = 16.300

REFERENCE DATA

SREF = 2690.0000 50.FT. XMRP = 1076.7000 INCHES
 LREF = 474.8000 INCHES YMRP = .0000 INCHES
 BREF = 936.7000 INCHES ZMRP = 375.0000 INCHES
 SCALE = .0100

RUN NO. 38/ 0 RN/L = 1.05 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CA	CAF	VLBAR
16.700	20.000	65.00000	.43500	-.06960	.70874	.38200	.22400	1.71000	.07980	.07990	.01307
16.400	20.000	70.00000	.43800	-.06980	.70864	.38400	.22500	1.71000	.08000	.08010	.01325
16.200	20.000	80.00000	.44000	-.06980	.70837	.38500	.22800	1.69000	.08200	.08210	.01406
16.300	20.000	90.00000	.44400	-.06910	.70727	.38800	.23100	1.68000	.08400	.08410	.01474
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

PARAMETRIC DATA

BETA = .000 RN/L = 1.100
 ELEVTR = 15.000 AILRON = .000
 RUDDER = .000 SPDBRK = 55.000
 BDFLAP = 16.300

RUN NO. 37/ 0 RN/L = .99 GRADIENT INTERVAL = -5.00/ 5.00

MACH	ALPHA	TIME	CN	CLM	XCP/L	CL	CD	L/D	CA	CAF	VLBAR
16.200	25.000	60.00000	.72400	-.09980	.70072	.61400	.39700	1.55000	.10000	.10000	.01256
15.900	25.000	63.00000	.72700	-.09960	.69991	.61700	.39800	1.55000	.10000	.10000	.01338
16.200	25.000	70.00000	.72800	-.09820	.69954	.61800	.39900	1.55000	.10100	.10100	.01447
16.300	25.000	80.00000	.73000	-.09770	.69925	.61800	.40100	1.54000	.10200	.10200	.01497
16.400	25.000	90.00000	.73000	-.09770	.69925	.61800	.40100	1.54000	.10200	.10200	.01503
	GRADIENT		.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000	.00000

(RT0012) (04 NOV 75)

AEDC VA489(0A-81), (B26C9F7M7N28)(M116E26)(VBR5)

(RT0012) (04 NOV 75)

AEDC VA4P910A-81), (B26C9F7M7N28) (W116E26) (V8R5)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	YMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	15.000	ATLRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	16.300			

PARAMETRIC DATA

RUN NO.	36/ 0	RN/L =	.82	GRADIENT INTERVAL =	-5.00/ 5.00
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[illegible]

RUN NO.	35/ 0	RN/L =	.99	GRADIENT INTERVAL =	-5.00/ -5.00
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[illegible]

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	15.000	AILRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	16.300			

PARAMETRIC DATA

AEDC VA489(0A-81), (B26C9F7M7N28)(W116E26)(V8R5)

(ST0012) (04 NOV 75)

RUN NO.	38/ 0	RN/L = 1.05	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA. AEDC VA 489. OAB1

PAGE 23

AEDC VA489(OA-81), (B26C9F7M7N28)(W116E26)(V8R5)
(ST0012) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	15.000	AILRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	16.300			

[illegible]

MACH	ALPHA	TIME	PO	P	Q (PSI)	TO	GRADIENT	INTERVAL	=	-5.00/	5.00	CPB	V-INF	VLBAR
6.300	30.000	70.00000	11378.00000	.00839	1.56000	4118.00000				.98000	.00125	.01540	.01351	
5.900	30.000	75.00000	10689.00000	.00907	1.54000	4229.00000				.82000	.00113	.01640	.01435	
6.000	30.000	80.00000	10230.00000	.00811	1.50000	4499.00000				.75000	.00102	.01720	.01500	
5.600	30.000	90.00000	9426.00000	.00879	1.45000	4598.00000				.67000	.00088	.01770	.01536	
5.500	30.000	100.00000	8622.00000	.00858	1.40000	4160.00000				.59000	.00080	.01890	.01655	
	GRADIENT	.00000	.00000	.00000	.00000	.00000				.00000	.00000	.00000	.00000	

MACH	ALPHA	TIME	PO	P	O(PSI)	TO	GRADIENT INTERVAL	=	-5.00/	5.00	RE-L	CPB	V-INF	VLBAR
6.200	35.000	55.0000012503.00000	.01070	1.95000	3579.00000				1.24000	.00408	.01360	.01217		
5.800	35.000	60.0000011587.00000	.01050	1.83000	4274.00000				1.01000	.00419	.01460	.01281		
5.600	35.000	70.0000010781.00000	.00885	1.60000	4394.00000				.82000	.00430	.01640	.01434		
6.100	35.000	80.00000 9754.00000	.00766	1.39000	4196.00000				.77000	.00440	.01710	.01502		
6.600	35.000	90.00000 8955.00000	.00613	1.20000	3695.00000				.78000	.00460	.01750	.01568		
	GRADIENT	.00000 .00000	.00000	.00000	.00000				.00000	.00000	.00000	.00000		

AE DC VA489(0A-81), (B26C9F7M7N28) (W116E26) (V8R5)

(RT0013) (04 NOV 75)

REFERENCE DATA

SRF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LRF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BRF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	ELEVTR	RUDDER	BDFLAP
0.00	0.00	0.00	0.00
0.05	0.05	0.05	0.05
0.10	0.10	0.10	0.10
0.15	0.15	0.15	0.15
0.20	0.20	0.20	0.20
0.25	0.25	0.25	0.25
0.30	0.30	0.30	0.30
0.35	0.35	0.35	0.35
0.40	0.40	0.40	0.40
0.45	0.45	0.45	0.45
0.50	0.50	0.50	0.50
0.55	0.55	0.55	0.55
0.60	0.60	0.60	0.60
0.65	0.65	0.65	0.65
0.70	0.70	0.70	0.70
0.75	0.75	0.75	0.75
0.80	0.80	0.80	0.80
0.85	0.85	0.85	0.85
0.90	0.90	0.90	0.90
0.95	0.95	0.95	0.95
1.00	1.00	1.00	1.00

PARAMETRIC DATA

[illegible][illegible][illegible][illegible]

AEOC VA489(OA-81), (B26C9F7M7N28)(W16E26)(V8R5)

(ST0013) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA
ELEVTR
RUDDER
BOFLAP

PARAMETRIC DATA

RUN NO.	42/ 0	RN/L =	.28	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	41/ 0	'RN/L = .19	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

RUN NO.	40/ 0	RN/L =	.22	GRADIENT	INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	39/ 0	RN/L =	.17	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

AEDC489(0A81) B26C9F7M7N28 WJ16E26 V8R5 INVERTED

(RT0014) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	AILROM	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	-11.700			

PARAMETRIC DATA

RUN NO.	43/ 0	RN/L =	.97	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	44/ 0	RN/L = 1.03	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	AILRON	=	.000
RUDDER	=	.000	SPDRBK	=	55.000
BOFLAP	=	-11.700			

PARAMETRIC DATA

AEDC489(OA81) B26C9F7M7N28 W116E26 V8R5 INVERTED

(ST0014) (04 NOV 75)

RUN NO.	43/ 0	RN/L =	.97	GRADIENT	INTERVAL =	-5.00/	5.00

[illegible]

DATE 04 NOV 75

TABULATED SOURCE DATA. AEDC VA 489. OA81

PAGE- 27

AE DC489(0A81) B26C9F7M7N28 W1GE26 V8R5 INVERTED

(5T0014) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SO.Ft.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BRF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	1.100
ELEVTR	=	.000	AILRON	=	.000
RUDDER	=	.000	SPDRK	=	55.000
BDFLAP	=	-11.700			

RUN NO.	44/ 0	RN/L = 1.03	GRADIENT INTERVAL = -5.00/ 5.00
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[illegible]

AEDC489(OA81) B26C9F7M7N28 W116E26 V8R5 INVERTED

(RT0015) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.250
ELEVTR	=	.000	ATLRON	=	.000
RUDDER	=	.000	SPDBRK	=	55.000
BDFLAP	=	-11.700			

RUN NO.	45/ 0	RN/L. =	.23	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

RUN NO.	46/ 0	RN/L =	.19	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

AEDC489(0A81) 826C9F7M7N28 W116E26 VBR5 INVERTED (ST0015) (04 NOV 75)

REFERENCE DATA

=	SREF	=	2690.0000	SO.FT.	XMRP	=	1076.7000	INCHES
=	LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
=	BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
=	SCALE	=	.0100					

BETA
ELEVTR
RUDDER
BDFLAP

RN/L	=	.250
AILRON	=	.000
SPOBRK	=	55.000

PARAMETRIC DATA

RUN NO.	45/ 0	RN/L =	.23	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

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RUN NO.      46/ 0  ·  RN/L =  .19  ·  GRADIENT INTERVAL =  -5.00/  5.00

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[illegible]

REFERENCE DATA

SREF	=	2690.0000	50. FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

BETA
ELEVTR
RUDDER
BOFLAP

RN/L	=	.500
AILRON	=	.000
SPOBRK	=	55.000

PARAMETRIC DATA

RUN NO.	47/ 0	RN/L =	.29	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]

DATE 04 NOV 75

.TABULATED SOURCE DATA, AEDC VA 489, OAB1

PAGE 29

AEDC489(OA81) B26C9F7M7N29 W116E26 V8R5 INVERTED

(ST0016) (04 NOV 75)

REFERENCE DATA

SREF	=	2690.0000	SQ.FT.	XMRP	=	1076.7000	INCHES
LREF	=	474.8000	INCHES	YMRP	=	.0000	INCHES
BREF	=	936.7000	INCHES	ZMRP	=	375.0000	INCHES
SCALE	=	.0100					

PARAMETRIC DATA

BETA	=	.000	RN/L	=	.500
ELEVTR	=	.000	AILRON	=	.000
RUDDER	=	.000	SPOBRK	=	55.000
80FLAP	=	-11.700			

RUN NO.	47/ 0	RN/L =	.29	GRADIENT INTERVAL =	-5.00/	5.00
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[illegible]